



รายงานการวิจัยเรื่อง

The Role of Universities in Producing Innovative Graduates

(บทบาทของมหาวิทยาลัยในการสร้างบัณฑิตที่มีความสามารถเชิงนวัตกรรม)

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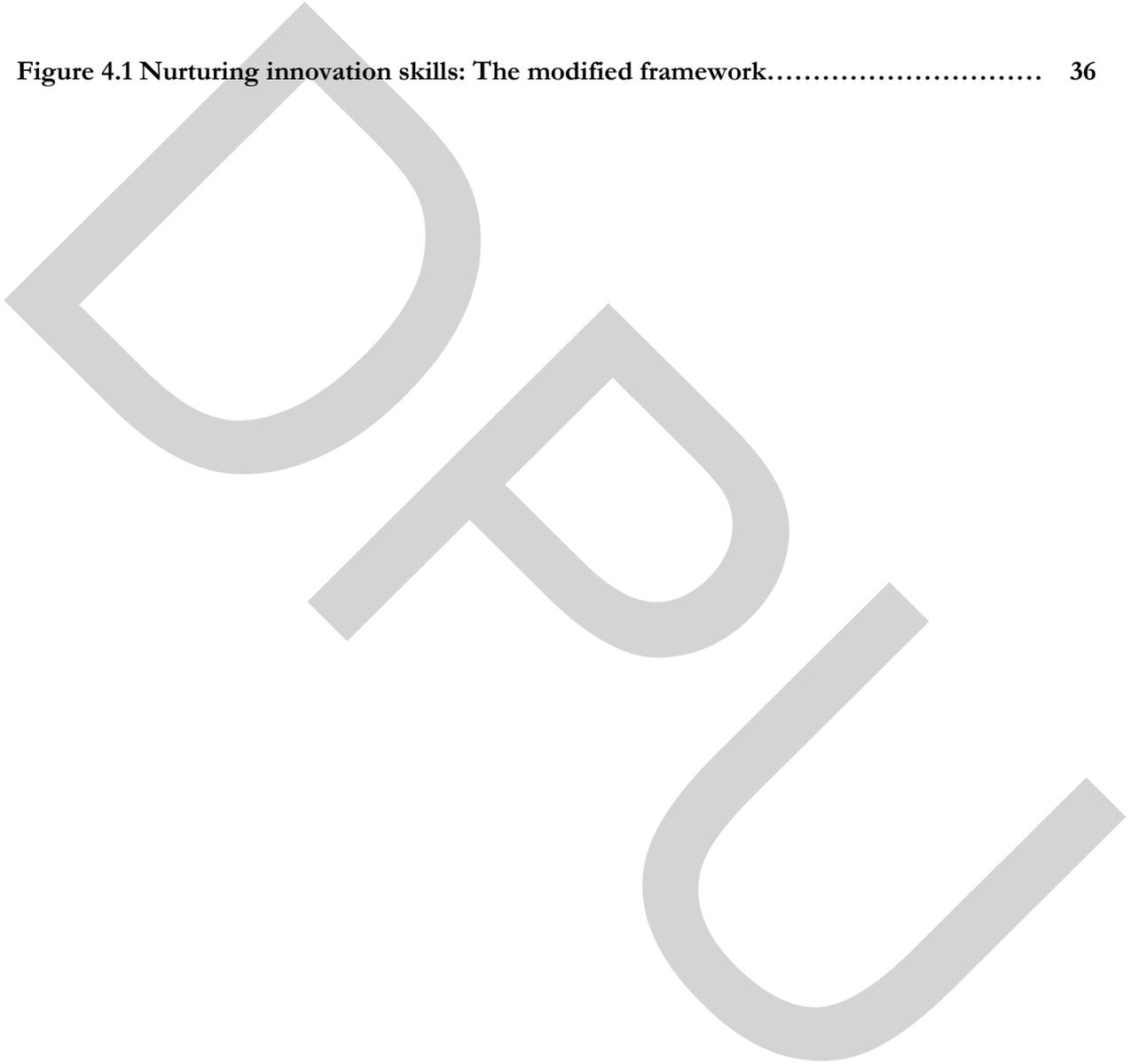
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Abstract

An innovative workforce has been increasingly required across many industries in the creative economy. Higher education plays a crucial role to develop human resources equipped with skills needed for innovation. This paper tends to explore mechanisms used by universities and faculties to nurture students' innovation skills.

With a qualitative approach, twenty-seven Deans and three Deputy Deans of thirty faculties (twenty-five creative and five business faculties), from ten universities in Bangkok, were in-depth and semi-structured interviewed.

The research found that the faculties perceive that innovation skills are necessary to their undergraduates' future careers. Innovation skills can be developed through a formal education system. In fact, the faculties play a key role to nurture students' innovation skills; while, the universities tend to play a supportive role. Innovation skills encompass creativity, self-efficacy, energy, risk-propensity, leadership, entrepreneurship and socialisation. The faculties and universities can produce innovative students by fine-tuning lecturers' attitudes on innovation, building lecturers' capabilities for innovation, developing integrated curriculum, designing pedagogies, fostering students' extra-curricular activities, and providing resources and infrastructure. This research suggests that the government should draw policies to encourage and support universities to nurture students' skills needed for innovation while driving the creative economy. The human resources policy of the nation should focus on building and increasing an innovative workforce, which is beyond a creative workforce.

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บทคัดย่อ

ภายใต้ระบบเศรษฐกิจเชิงสร้างสรรค์ แรงงานที่มีความสามารถเชิงนวัตกรรมกำลังเป็นที่ต้องการเพิ่มขึ้น ในหลายอุตสาหกรรม การศึกษาระดับอุดมศึกษาจึงมีบทบาทสำคัญอย่างยิ่งยวดในการพัฒนาทรัพยากรบุคคลให้ เทียบพร้อมด้วยทักษะที่จำเป็นต่อการสร้างนวัตกรรม งานวิจัยเชิงคุณภาพนี้มุ่งศึกษากลไกของมหาวิทยาลัยและ คณะวิชา ที่ใช้บ่มเพาะทักษะเชิงนวัตกรรมให้นักศึกษา

ผู้วิจัย ได้สัมภาษณ์เชิงลึกคณบดี 27 ท่าน และรองคณบดี 3 ท่าน ในคณะวิชาที่สอนด้านความคิด สร้างสรรค์โดยตรง 25 คณะ และคณะวิชาที่สอนด้านบริหารธุรกิจ 5 คณะ จากมหาวิทยาลัยในกรุงเทพมหานคร 10 แห่ง

ผลการศึกษาพบว่า คณะวิชาตระหนักว่าทักษะเชิงนวัตกรรมเป็นสิ่งจำเป็นต่ออนาคตการทำงานของ นักศึกษา ทั้งนี้ ระบบการศึกษาสามารถบ่มเพาะนักศึกษาให้มีทักษะเชิงนวัตกรรมได้ โดยมีคณะวิชาเป็น หน่วยงานหลัก ขณะที่มหาวิทยาลัยเป็นหน่วยงานสนับสนุนในการดังกล่าว

ทักษะเชิงนวัตกรรม คือ ทักษะต่าง ๆ ที่ช่วยให้นักศึกษาสามารถสร้างนวัตกรรมได้ อันประกอบไปด้วย 1) ความคิดสร้างสรรค์ 2) การรับรู้ความสามารถของตนเอง 3) ความกระตือรือร้นและแรงผลักดัน 4) การยอมรับ ความเสี่ยง 5) ความเป็นผู้นำ 6) ความเป็นผู้ประกอบการ และ 7) ความสามารถในการเข้าสังคม

คณะวิชาและมหาวิทยาลัยสามารถผลิตบัณฑิตที่มีความสามารถเชิงนวัตกรรมได้ โดยการ 1) ปรับทัศนคติ ของอาจารย์ที่มีต่อนวัตกรรมให้เหมาะสม 2) พัฒนาศักยภาพด้านนวัตกรรมให้แก่อาจารย์ 3) สร้างหลักสูตรแบบ บูรณาการ 4) ใช้วิธีการเรียนการสอนที่หลากหลาย 5) ส่งเสริมให้นักศึกษาทำกิจกรรมนอกเวลาเรียน และ 6) จัดเตรียมทรัพยากรและสิ่งอำนวยความสะดวกต่าง ๆ ให้เหมาะสมกับการพัฒนาทักษะเชิงนวัตกรรม

งานวิจัยชิ้นนี้เสนอว่า รัฐบาลควรออกนโยบายส่งเสริมและสนับสนุนมหาวิทยาลัยในการสร้างบัณฑิตที่มี ความสามารถเชิงนวัตกรรม เพื่อช่วยขับเคลื่อนระบบเศรษฐกิจเชิงสร้างสรรค์ของประเทศ นอกจากนี้ นโยบาย การพัฒนาทรัพยากรบุคคลของประเทศควรมุ่งสร้างแรงงานที่มีความสามารถเชิงนวัตกรรม แทนแรงงานที่มีแต่ ความคิดสร้างสรรค์เพียงอย่างเดียว

Chapter 1

Introduction

1.1 Research background

The fundamental driver for the growth of an economy in highly competitive markets is innovation (Silverberg and Verspagen, 2005, Verspagen, 2005). Innovative products, service offerings and processes engender competitive advantages to innovators and innovation adopters (Cantwell, 2005). As a consequence, the economy that possesses innovative actors and mechanisms supporting innovation tends to grow rapidly. With an attempt to stimulate the economy, several actors in the economy need to co-operate to enable innovation. Therefore, the rapid growth of the country's economy depends on innovative capabilities of actors and interactions among the actors in that particular country. Innovation can be generated through the National Innovation Systems (NIS) that contains the networks of institutions and factors (i.e. economic, social, political and organizational factors) whose activities and interactions influence the development, diffusion and use of innovation (Edquist, 2005).

Among actors in NIS, universities are one of institutions playing important roles to stimulate innovations for the country. Universities increasingly involve in an innovation process in the economy. From the starting point, known as Mode1, the role of universities is teaching with an aim at supporting human capital and producing graduates (as potential innovators). Then, universities transform to Mode 2. They generate new knowledge to economies through basic and applied research activities or Research and Development (R&D) (Mowery and Sampat, 2005). Recently, in transition to Mode 3, universities have started to act as a knowledge hub and commercialise new ideas, products and technologies through incubation and intermediation activity (Etzkowitz, 2002, Youte and Shapira, 2008).

Meanwhile, some scholars have increasingly paid attentions to study the role of universities as an R&D activity (Mowery and Sampat, 2005) and an incubation activity (Youte and Shapira, 2008,

Etzkowitz and Leydesdorff, 2000). Importantly and fundamentally, the teaching function of universities plays a significant role to produce innovative graduates, which will be potential innovators and an innovative workforce in the NIS. Innovators and an innovative workforce are key actors who utilise resources and supporting systems to induce innovations in NIS (Pianta, 2005).

To produce an innovative workforce, an education system cannot be taken for granted. At a level of higher education (as the final stage of education before going to labour markets), universities have to put efforts in producing graduates who possess skills needed for innovation (hereafter referred to as innovation skills).

In particular for Thailand, the government has attempted to boost the concept of creative economy in order to stay competitively in the global marketplace. However, the government has encountered a situation that an innovative workforce in the Thai economy is not sufficient (World Bank, 2008). As a result, the Thai government and education agencies have to commence building innovative graduates who will be potential innovators and an innovative workforce for the future. This research, therefore, aims at exploring ways that universities perform their teaching functions to produce innovative graduates, in a context of Thailand.

Despite the transformation of universities' roles, universities have to recognise that teaching and developing human resources is a main function, which can create value to the nation. Therefore, together with developing the roles of universities as Mode 2 and Mode 3, universities have to focus on the teaching function, as Mode 1, to produce innovative graduates in the first place (Mowery and Sampat, 2005).

1.2 Research questions

To explore ways that universities produce innovative graduates, the role of universities and faculties in nurturing students' innovation skills of undergraduate students (here after referred to as students) must be discovered. This is because students who possess innovation skills will be innovative graduates in the future. In particular, the research focuses on an investigation of ways that universities and faculties nurture students' innovation skills. This aim is accomplished by addressing two research questions.

1. What are skills that students need to develop to be able to induce innovations?

2. How do universities nurture students' innovation skills?

1.3 Scope of investigation

This research investigates the role of universities in producing innovative graduates. Universities and faculties are examined regarding to two issues. Firstly, skills that students need to develop in order to induce innovation are indicated. Secondly, mechanisms that can nurture those skills are revealed.

The unit of analysis in this research is the university that provides education on the creative (as the main focus in this study) and business disciplines. The creative disciplines examined include Engineering, Computer Sciences, Communication Arts, Architecture and Fine & Applied Arts. These creative disciplines provide students with creativity-related knowledge, together with expertise in each particular discipline. The creativity-related knowledge refers to knowledge and learning processes that enhance an ability to develop ideas into the future, and to solve problems and curiosity. While creativity engenders new and different ideas, commercialisation of new ideas induces innovation. Therefore, the business discipline is taken into account. The study investigates ten universities – classified into three public universities, two private universities, two Rajabhat universities and three Rajamangala universities of technology – that are located in Bangkok. Within the ten universities, twenty-five faculties offering the creative studies and five faculties providing the business studies are examined. The empirical findings and explanation are based on the data collected in the fieldwork carried out between May and August 2011. This result can only be applied to the ten universities and thirty faculties under investigation within this period.

1.4 Methodological approach

This exploratory study deployed a multiple-case study to reveal the role of universities in producing innovative graduates. Based on suggestion by Yin (2003), a multiple-case study was used to gain insightful understandings of a phenomenon in an individual organisation. In this study, the ten selected universities are 1) Chulalongkorn University, 2) Silpakorn University, 3)

Thammasat University, 4) Bangkok University, 5) Dhurakij Pundit University, 6) Suan Dusit Rajabhat University, 7) Suan Sunandha Rajabhat University, 8) Rajamangala University of Technology Phra Nakon (RMUTP), 9) Rajamangala University of Technology Rattanakosin (RMUTR) and 10) Rajamangala University of Technology Krungthep (RMUTK). Thirty faculties that provide creativity-related and/or business-related knowledge in those universities are studied.

Interviews were the main method used to collect data as using the interview method can provide the researcher with insightful data and real understandings from the actors involved in nurturing innovation skills of students. In this research, in-depth and semi-structured interviews were used.

1.5 Chapter outlines

This research attempts to explore how universities produce innovative graduates. Chapter Two reviews the related literature – i.e. innovation, innovation skills, and universities and innovation system. Chapter Three identifies research questions, draws an initial research framework, and describes the research methodology and methods used to collect and analyse the data. Chapter Four shows the finalised framework and results of the study. The research ends with the conclusion in Chapter Five.

Chapter Two looks at literature on creativity and innovation, innovation skills and universities in the innovation system. Based on these existing issues, the main consideration is ‘how do universities help produce innovative graduates to the creative economy?’

Chapter Three presents two research questions, an initial research framework, and the methodologies applied for this study. Validity and credibility of the research is also discussed. The chapter also lays out an introduction of the ten universities and thirty faculties.

Chapter Four contains the main findings of this research. The chapter shows that the faculties play a key role to nurture students’ innovation skills; while, the universities play a supportive role to the faculties and students. Through six mechanisms, including fine-tuning lecturers’ attitudes on innovation, building lecturers’ capabilities for innovation, developing integrated curriculum, designing pedagogies, fostering students’ extra-curricular activities, and providing appropriate resources, innovation skills of students can be developed. Innovation skills encompass creativity,

self-efficacy, energy, risk-propensity, leadership, entrepreneurship and socialisation. Nevertheless, the faculties may encounter difficulties in building innovation skills of students because some limitations occur.

The research then concludes with **Chapter Five**. This chapter provides a summary of the research process, findings and discussions. Contributions and implications of the research are suggested and limitations of applicability are discussed. Further research agenda are also proposed.



Chapter 2 Literature Review

This study primarily explores innovation skills and mechanisms used by universities to nurture innovation skills of students. The review of the literature forms the foundation of the study and identifies a gap in existing knowledge. As this research is multidisciplinary, the three main areas of literature reviewed include creativity and innovation, an innovative workforce and the role of universities in the NIS. This chapter discusses the meanings of creativity and innovation. It also reviews an importance of an innovative workforce and skills needed for innovation. The role of universities in the innovation system is also explained.

This chapter is divided into four sections. Section 2.1 portrays the nature of creativity and innovation. Section 2.2 highlights issues in the literature of an innovative workforce. Section 2.3 briefly shows the role of universities in the innovation system. Finally, the chapter ends with a conclusion in Section 2.4.

2.1 Creativity and innovation

The economic growth comes from innovation and new knowledge (Silverberg and Verspagen, 2005, Verspagen, 2005). The organisations that need to stay competitively in the market have to induce innovation (Cantwell, 2005). Innovation is a process of translating inventions and new ideas into commercial outcomes (Weinstein and Baumol, 1999). In other words, innovation is a combination of creativity (generation of new ideas) and implementation (Flynn and Chatman, 2004).

2.1.1 Creativity

Creativity is an important source of innovation and productivity growth in the creative economy (Florida, 2005, Chell and Athayde, 2009). It refers to abilities to envision the development of the

idea into the future, and to connect ideas, to tackle and solve problems and curiosity (Chell and Athayde, 2009). Amabile (1996) describes that creativity is a function of three components: task motivation, domain-relevant skills, and creativity-relevant processes. Robinson (2001) mentions that creativity can be fostered through formal and informal learning.

2.1.2 Innovation

Beyond creativity, the successful exploitation of new ideas engenders innovation. Some scholars characterise innovation as a process of change, transformation and commercialisation (Rogers, 2003, Weinstein and Baumol, 1999, Tidd et al., 2001, Flynn and Chatman, 2004). In more details, innovation is a process of new ideas, objects and practices to be created, developed or reinvented (Rogers, 2003). Tidd, Bessant, & Pavitt (2001) note that innovation is a process of creating new ideas from opportunities and then transforming the ideas into practices. Obviously, developing creativity is the starting point of an innovation process. Then, exploitation and/or commercialisation of new ideas can bring about yields and/or utmost advantages.

Innovation is basically categorised into product innovation (i.e. changes in products and services firms offer) and process innovation (i.e. changes in the ways firms create and deliver those offerings) (Francis and Bessant, 2004). In accordance with a degree of novelty, incremental innovation tends to be significant improvement or adaptation; meanwhile, radical innovation brings about breakthroughs (Tidd et al., 2001). Innovation is not a linear process. The interactive and iterative process of innovation leads to complexity in managing innovation. At the macro level, the rapid growth of a country's economy depends on innovative capabilities of actors and interactions among the actors in that particular country (Edquist, 2005). At the micro level, in an organisation, several actors and their interactions involve in an innovation process (Sutthijakra, 2008). New ideas and innovation are derived from the diversity of perspectives (Boni et al., 2009). Inducing innovation also relies on a group of participants who understand at least some aspects of each others' expertise (Thursby et al., 2009).

2.2 An innovative workforce

Not only do business organisations strive to generate innovation, but also they put efforts to acquire an innovative workforce (McWilliam and Haukka, 2008). Kay, Fonda, & Hayes (1998) also mention

that companies, in the changing environments, need workers who have technological skills, innovative and progressive ideas, and abilities to respond creatively and confidently in any circumstances.

2.2.1 An innovative workforce: Beyond a creative workforce

Despite of an importance of an innovative workforce to the economy, little literature on an innovative workforce exists. On the other hand, literature on a creative workforce has been dominated. McWilliam and Haukka (2008) explain that creative capital is the human ingenuity and high-level problem-solving skill that lead to fresh opportunities, ideas, products and modes of social engagement. Creative thinkers possess ideas that can be turned into valuable products and services (Florida and Goodnight, 2005). From a perspective of arts, the CCI (2007) describes that the creative workforce includes those who work in the cultural and creative industry sectors; as well as, those who work in creative occupations in the wider economy. From a view of organisation studies, creative capital exists at every level of an organisation and distributed throughout a profession and/or an organisation (McWilliam and Haukka, 2008).

However, creativity is an important part of innovation. Creativity engenders variations, while innovation brings advantages to organisations through exploitation and commercialisation of the variations. A workforce has to develop abilities to be innovative, not only creative.

2.2.2 Innovation skills

An innovative workforce has to employ skills needed for innovation which is beyond creativity. Chell & Athayde (2009) explicate five skills underpinning innovation skills, including creativity, self-efficacy, energy, risk-propensity and leadership. Firstly, creativity is explained as imagination, connecting ideas, tackling and solving problems and curiosity. Secondly, self-efficacy refers to self belief, self assurance, self awareness, feelings of empowerment and social confidence. Self-efficacy can be described as people's beliefs about their personal capabilities, which is based on past performance experiences, personal factors, and environmental influences (Lemons, 2010). Lemons (2010) also mentions that individuals will behave in ways that reflect their identities, if students do not believe that they are creative, then they will not decide to be creative.

As innovation is frequently slow and frustrating (Rogers, 2003), innovators need to be able to bear with confusion, and to tolerate the uncertainties and social incomprehension. Therefore, for the

third skill, energy contains drive, enthusiasm, motivation, hard work, persistence and commitment. Fourthly, risk-propensity is a combination of risk tolerance and the ability to take calculated risks. Finally, leadership encompasses vision and the ability to mobilise commitment. Furthermore, NESTA (2008) mentions that entrepreneurial skill underlies innovation because it allows seizing and exploiting opportunities, solving issues and problems, and generating and communicating ideas. Moreover, socialisation necessitates creativity as it builds a network for discussions and recommendations for future work (Bathelt et al., 2004). Innovation skills can be learned in schools and colleges (Chell and Athayde, 2009).

2.3 The role of universities in innovation system

2.3.1 University in transition toward innovation

Innovation can be generated through the National Innovation Systems (NIS) that contains the networks of institutions and factors (i.e. economic, social, political and organisational factors) whose activities and interactions influence the development, diffusion and use of innovation (Edquist, 2005). Among actors in NIS, universities are one of institutions playing important roles to stimulate innovations for the country. Universities increasingly involve in an innovation process in the economy. From the starting point, known as Mode1, the role of universities is teaching with an aim to support human capital and produce graduates (as potential innovators). Then, universities transform to Mode 2, which is generating new knowledge to economies through basic and applied research activities or Research and Development (R&D) (Mowery and Sampat, 2005). Recently, in transition to Mode 3, universities have started to act as knowledge hub and commercialise new ideas, products and technologies through incubation and intermediation activity (Etzkowitz, 2002, Youte and Shapira, 2008).

Meanwhile, there has been an increase in innovation studies about the role of universities as an R&D activity (Mowery and Sampat, 2005) and an incubation activity (Youte and Shapira, 2008, Etzkowitz and Leydesdorff, 2000). In fact, the teaching function of universities cannot be overlooked as it plays a significant role to produce innovative graduates, which will be potential innovators and an innovative workforce in the future. It is worth noting that innovators and an

innovative workforce are key persons to utilise resources and supporting systems to induce innovations in NIS (Pianta, 2005).

2.3.2 Mechanisms nurturing innovation skills

Several studies indicate mechanisms that possibly foster creativity and innovation. NESTA (2008) identifies that many opportunities to develop innovative behaviours and attitudes within the curriculum and through extracurricular work and informal learning. In addition, students can learn to become innovative when the university provides a setting that contains proper pedagogies and environments (Harkema and Schout, 2008). Beyond individual intelligence, creating environments can foster innovation (Hargadon and Sutton, 2000). The following passages provide explanations of mechanisms that foster innovative behaviours.

The curriculum and the way that it is delivered encourage the skills that engender thinking toward innovation in students (Johnson, 2009). Thursby, Fuller, & Thursby (2009) suggest the integrated approach to construct the curriculum for innovation because integrated learning among different fields can generate new variations. Importantly, an interdisciplinary course is necessary for nurturing students' innovative behaviours as students have opportunities to capitalise on the diversity of perspectives (Boni et al., 2009). In particular, NESTA (2008) suggests that students have to enhance entrepreneurial and innovative mindsets to become an innovative workforce in the economy. The study of Freel (1999) shows that firms tend to improve technical and marketing skills to develop innovative capabilities of employees as technical skills alone cannot yield innovations. Also, Radcliffe (2005) mentions that engineering students must choose to be nonconformist, commercially pragmatic and cooperative. Therefore, commercialisation can be integrated into the curriculum of the creative disciplines (Boni et al., 2009, Thursby et al., 2009). Moreover, design should be embedded into other disciplines since thinking as a designer can transform the way of developing products, services and processes (Brown, 2008, Boni et al., 2009). Education through arts can develop creativity, analysis and interpretation that are important to innovation (Sudmails, 2007).

In addition, the role of lecturer has an impact on students' innovation skills. Lecturers are no longer the ones with solution to the exercise but the ones who stimulate the students' projects and open-mindedness (Mustar, 2009). Lecturers and students should act as co-creators of information products that are created by a network of people and ideas (McWilliam and Haukka, 2008). The lecturers have to stimulate students to interact with the lecturers and with the guest professionals;

and to run students' projects (Mustar, 2009). There should be a flexible interpretation of teaching styles that enable young people to express themselves innovatively through assignments, class work, homework and projects (Chell and Athayde, 2009). Moreover, team-teaching offers a chance to integrate other lecturers to nurture an innovative workforce as diverse participants can share different perspectives, where students can learn from (Kay et al., 1998).

Moreover, the concept of student-centred learning stimulates students to make decisions and express their identities and thoughts. It tends to boost problem-solving skills and an attitude conducive to change (Harkema and Schout, 2008). Experiential learning gives a chance for students to experiment and discover new ways of thinking (NESTA, 2008, Dewett and Gruys, 2007). As innovation tends to come from collective efforts, a group assignment or team working allows everyone learn in a co-operative activity (CCI, 2007, Boni et al., 2009, Thursby et al., 2009). Chell & Athayde (2009) add that projects that are cross-disciplinary should not necessarily be marked, but used as a means of exploring a subject to enable more creativity of students.

Extra-curricular activities or informal activities can broaden students' perspectives, which is important to creativity (CCI, 2007). Taking parts in unions, clubs and societies can offer students entrepreneurial experiences that allow for experimentation with new ideas and concepts (NESTA, 2008).

2.4 Conclusion

An innovative workforce becomes a crucial source of innovation in organisations. Demands for such workforce have been increasing in the economy. While firms themselves put efforts to improve innovative abilities of their employees, universities can help producing innovative graduates through an education system. Skills that need to be nurtured to be able to induce innovation can be learned. Innovation skills include creativity, self-efficacy, energy, risk-propensity, leadership, entrepreneurship and socialisation. Mechanisms used by universities to nurture such students' skills can be an integrated curriculum, a coaching role of lecturers in teaching and learning, the use of student-centred learning and extra-curricular activities. Despite literature on the roles of universities in NIS, academia and an education agency still require more studies, particularly, on how universities produce innovative graduates to the Thai economy.

Chapter 3

Research Methodology: Methods and an introduction to the cases

This chapter formulates research questions to investigate the role of universities in producing innovative graduates; to discuss a research approach and methods used for addressing the research questions; and to provide an introduction to the cases examined.

The research questions were constructed based on the gap found in the literature in the previous chapter. A multiple-case study was deployed to study how universities produce innovative graduates. To provide a basic understanding of the cases, the chosen universities and their selected faculties are briefly introduced in this chapter.

Specifically, the research aim and questions are presented in section 3.1. Section 3.2 portrays an initial research framework. The multiple-case study, data collection process and tools (interview and documentation) and data analysis are illustrated in section 3.3. Section 3.4 introduces the universities and faculties selected to provide a background to the field research. The chapter ends with conclusion in section 3.5.

3.1 Research aim and questions

Developing an innovative workforce is recently recognised by companies as it brings about competitive advantages to the firms. Universities, as an educational agent at a level of higher education – the final stage of education before going to labour markets, can put efforts in producing graduates possessing innovation skills. Little literature on developing students' innovation skills exist. Therefore, this insightful research on producing innovative graduates, particularly by nurturing

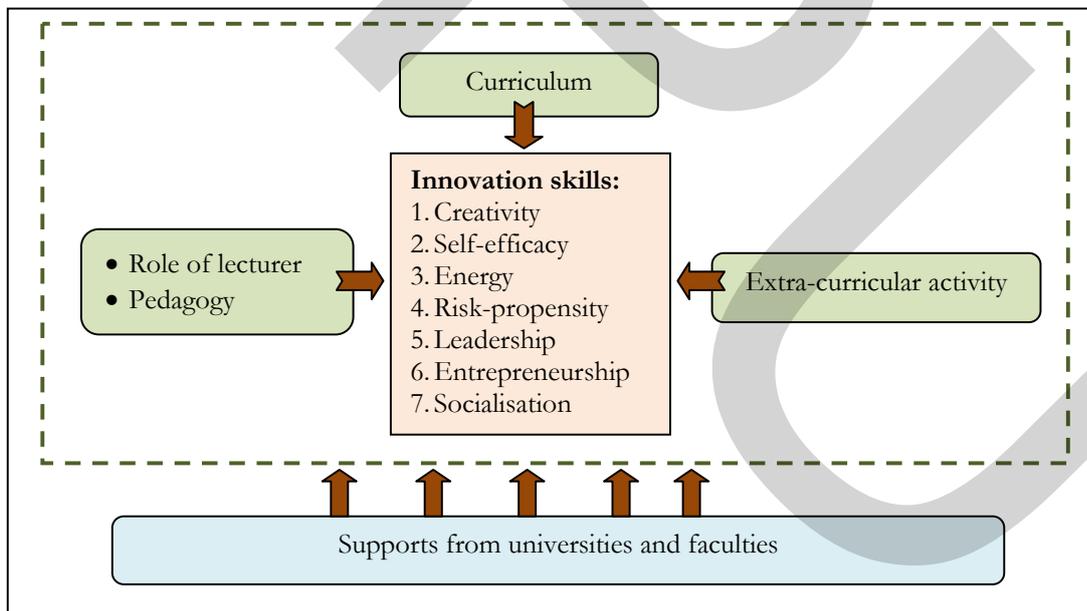
innovation skills, in the context of the education system in Thailand, is required. Two research questions are formulated as follows.

1. What are skills that students need to develop to be able to induce innovations?
2. How do universities nurture students' innovation skills?

3.2 An initial research framework: Building a loose framework

This section draws an initial framework to study the role of universities in producing innovative graduates. The framework covers three issues: innovation skills, mechanisms that directly nurture those skills, and supports from universities and faculties. Figure 3.1 presents an initial research framework.

Figure 3.1 An initial research framework: Nurturing innovation skills



Source: Author, literature review

Universities and faculties can nurture students' innovation skills through a formal education system, according to Robinson (2001) and Chell and Athayde (2009). Skills that students need to develop in order to induce innovations are creativity, self-efficacy, energy, risk-propensity, leadership, entrepreneurship and socialisation (Chell and Athayde, 2009, NESTA, 2008, Bathelt et al., 2004).

Students can develop those skills through mechanisms provided by universities and faculties. Three mechanisms suggested are 1) an integrated curriculum (Thursby et al., 2009, NESTA, 2008, Radcliffe, 2005, Boni et al., 2009), 2) a coaching role of lecturers and pedagogies based on the concept of student-centre learning (Mustar, 2009, McWilliam and Haukka, 2008, Chell and Athayde, 2009, Harkema and Schout, 2008, Dewett and Gruys, 2007, NESTA, 2008), and 3) extra-curricular activities (NESTA, 2008, CCI, 2007).

Universities and faculties have to provide supports and resources (i.e. physical and non-physical forms) to create environments and spaces that stimulate students to develop skills needed for innovation (Harkema and Schout, 2008, Hargadon and Sutton, 2000).

3.3 Research methodology

The research methodology discusses five main issues: rationale of the research methodology, research design, research operationalisation, data collection and data analysis.

3.3.1 Rationale

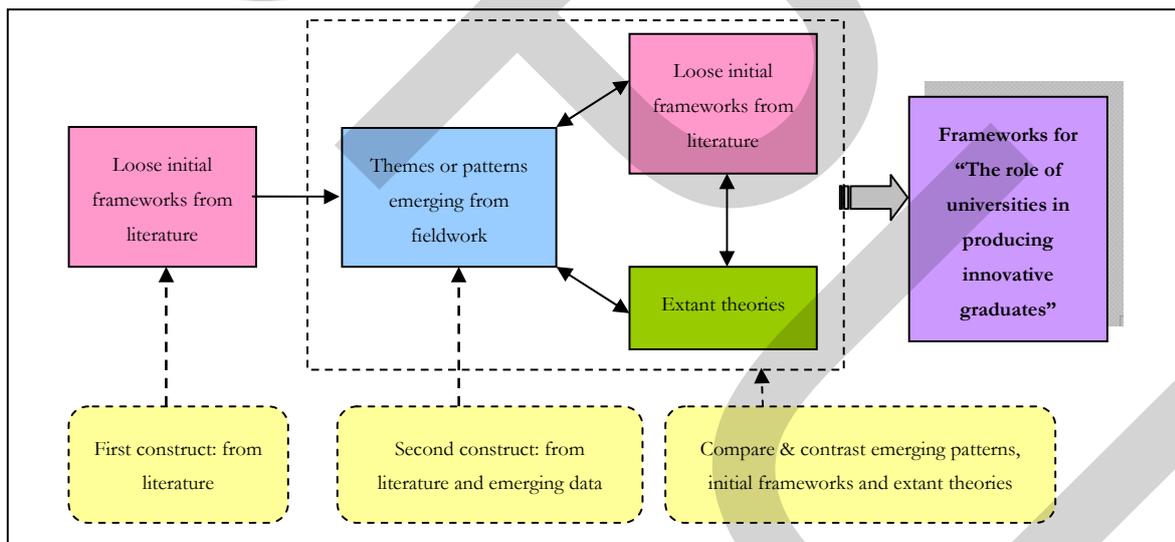
This research takes a *social constructivist approach* – that subjective meaning of a phenomenon is developed via interactions among participants in the setting, and the reality of the phenomenon is derived from their perceptions and interpretations of the phenomenon (Creswell, 2007). This study seeks to investigate ways that universities produce innovative graduates.

This research employs a qualitative and exploratory case study approach to study and interpret the phenomenon in terms of the meanings people bring to it (Denzin and Lincoln, 2000:3). Producing innovative graduates by universities involves not only several actors and their interactions, but also several factors. This cannot be sufficiently captured by a quantitative approach that employs

predetermined information or variables from the literature, and simply explained through a survey method or a mathematical model.

As argued in Chapter Two, the role of universities in producing innovative graduates cannot be completely explained by the literature. Therefore, building a theory from the case study to explain this phenomenon is one focus of this study. However, it is argued that it is impossible to achieve this ideal process of building theory from the field; therefore, a *priori* specification of constructs or a loose initial framework should be developed to shape a focus of the research (Eisenhardt, 1989). For this research, therefore, an initial framework to address the two research questions are developed to act as tentative theories or platforms for building theories, not testing theories. Issues or patterns emerging from the field are taken into account to expand the theories, leading to the resultant theories that are not necessarily similar to the initial frameworks. Figure 3.1 depicts the process of theory-building in this study.

Figure 3.2 A process of theory building



Source: Author, adapted from a process of building theory from case study research by Eisenhardt (1989)

The first tentative theory is set out from the literature to draw the loose scope of the study. The second tentative theory is developed from emerging patterns or issues from the field. These two tentative theories, called ‘constructs’ by Eisenhardt (1989), and key issues in the literature are compared and contrasted to come up with the resultant theory. Although an initial framework

shapes the initial design of theory building research, the data from the field plays a major role to build, expand and refine the theory. This research is inductive as the initial framework is treated as a loose framework that can be expanded and amended according to empirical observation. In short, this research is an emerging one where research questions and the direction of research are continually shaped throughout the processes of data collection and analysis.

3.3.2 Research design: The case study and multiple-case studies

A rationale of using the case study approach is described as an introduction to multiple-case studies. Then, multiple-case studies are explicated.

3.3.2.1 The case study approach

This research uses a case study approach. This method is appropriate to address 'how' and 'why' questions (Yin, 2003). It focuses on researching details in the situations being investigated in order to gain sufficient information to explain the unique characteristics of each case study (Gauri et al., 1995), and provide an understanding of the context of the research and the processes being enacted (Easterby-Smith et al., 1991). The case study is particularly appropriate to this exploratory research on the role of universities in producing innovative graduates because it focuses on exploring the actions and interactions of actors (the faculty management, lecturers, students and external organisations), and mechanisms that nurture innovation skills of students.

3.3.2.2 Multiple-case studies

The research is based on a multiple-case study approach. Multiple-case studies offer more compelling evidence that tends to make the study more robust because of a logic of replication that results are verified and refined by additional cases (Yin, 2003:46). To build theories from case studies, selected cases should be likely to be replicated or extend the emergent theory – an approach called 'theory sampling' (Eisenhardt, 1989). A theoretical replication is adopted in this research, where selectively diverse (rival) cases are examined in anticipation of *contrasting* results (Yin, 2003). The contrasting results will extend the emergent theory; whereas, the same results will replicate the resultant theory (Yin, 2003, Eisenhardt, 1989). Thus, in this research, there is a rationale behind an application of *multiple-case studies* to investigate the complex situation of nurturing students' innovation skills. More specifically, multiple-case (embedded) studies are designed to explore the

role of universities in nurturing innovation skills of students since mini-case studies are embedded in each main case.

3.3.3 Research operationalisation

The main criterion for selecting the organisations to be examined was universities in Bangkok which have faculties offering creative and/or business disciplines. For this study, universities were chosen since 1) they play an important role to develop human resources for the economy, and 2) they are at the final stage of education system to produce graduates for the labour markets. Specifically, for theoretical replication (Yin, 2003), ten universities in four diverse groups – classified as public universities, private universities, Rajabhat universities, or Rajamangala universities of Technology – were selected. Basically, universities in Thailand have been categorised into four different groups according to their different degrees of government supports and heritages. The public universities have been funded by the government. Some of them are independent as government-supported public universities. The private universities are not operated and funded by the government. The Rajabhat universities have transformed from Rajabhat Institutes aiming at providing higher education to regional provinces; meanwhile, the Rajamangala universities of Technology have transformed from Rajamangala Institutes of Technology. The Rajabhat universities and the Rajamangala universities of Technology have been funded by the government.

In particular, the universities that provide the creative and business faculties in Bangkok were approached. The creative and business faculties were focused because they provide knowledge that directly contributes to innovation. For the creative disciplines, twenty-five faculties offering creativity-related knowledge in Engineering, Computer Sciences, Communication Arts, Architecture, and Fine & Applied Arts were examined because they tend to produce graduates for the creative industries. According to the Department for Culture Media and Sport (DCMS) in the UK, the thirteen creative industries refers to Advertising, Architecture, Art and Antiques Markets, Crafts, Design, Designer Fashion, Film & Video, Interactive Leisure Software, Music, Performing Arts, Publishing, software & Computer Services, and Television & Radio. In addition, five business faculties were studied. In total, thirty faculties could be accessed and examined. It is worth noting that the selected disciplines are embedded in the faculties that may be called in different names by each particular university. The ten universities and thirty faculties selected are presented in Table 3.1.

Table 3.1 The selected universities and faculties

University classification	University	Faculty
Public university	Chulalongkorn University	Engineering Communication Arts Architecture Fine & Applied Arts Commerce & Accountancy
	Silpakorn University	Decorative Arts Architecture Painting, Sculpture & Graphic Arts
	Thammasat University	Fine & Applied Arts Architecture & Planning
Private university	Bangkok University	Engineering Communication Arts Fine & Applied Arts Business Administration
	Dhurakij Pundit University	Information Technology Engineering Communication Arts Fine & Applied Arts Business Administration
Rajabhat University	Suan Dusit Rajabhat University	Management Science (Communication Arts Programme and Business Administration Programme) Science & Technology
	Suan Sunandha Rajabhat University	Management Science (Communication Arts Programme and Business Administration Programme) Fine Arts Industrial Technology Science & Technology
Rajamangala University of Technology	Rajamangala University of Technology Phra Nakon (RMUTP)	Engineering Industrial Textiles & Fashion Design
	Rajamangala University of Technology Rattanakosin (RMUTR)	Engineering Architecture & Design
	Rajamangala University of Technology Krungthep (RMUTK)	Engineering

Source: Author, empirical investigations

After identifying the cases to be studied, data were gathered by using interviews and documentation.

3.3.4 Data collection: Interviews and documentation

The interview method is introduced and a process of conducting interviews in the field is explained.

3.3.4.1 Interview method

The main method used to collect data was face-to-face interviews. To explore such complex phenomenon, talking to individuals who have direct experiences in that situation is likely to provide rich information (Manson, 2002). Information comes from the meanings which interviewees attach to the situations (Easterby-Smith et al., 1991). Therefore, using the interview method can provide data and understanding from the actors involved in producing innovative graduates. The informants were the management of the chosen faculties as they could explain how universities and faculties nurture innovations skills. In this study, information from the management of the faculties is sufficient to understand the role of universities in producing innovative graduates. Meanwhile, the management of the university level could not be accessible by the researcher. A purposeful sampling strategy was used to connect with the right informants who can provide insightful information. As suggested by Eisenhardt (1989), questions probing for specific details in subsequent interviews were modified based on observations made during initial interviews.

3.3.4.2 The interviewing process

In-depth and semi-structured interviews were used. Some interview questions were prepared as a guidance to gather data. Once the fieldwork started, the issues and interview questions were amended to suit each particular interviewee in order to collect insightful and sufficient data. The management were contacted through telephone calls and emails. An interview guide was sent via fax or attached to an email. The interview guide was developed (see details in appendix 1). At the start of the interviews, confidentiality was discussed and permission for recording interviews was asked, as suggested by King (2005a). All interviews were conducted face-to-face. In total, twenty-seven Deans and three Deputy Deans in thirty faculties were interviewed with an average time of fifty minutes between May and August 2011 (see details in appendix 2). To supplement the data collected from interviewing, secondary data was gathered from web sites and annual reports of the universities and faculties.

3.3.5 Data analysis

A challenge of qualitative research is how to make sense of the data collected. Analysis of texts – from thirty interview transcriptions, annual reports and information from websites – was used to find emerging themes. Thus, templates (King, 2005b) were applied to thematically organise textual data for analysis and interpretation. By using template analysis, a ‘template’ is produced from

'coding' to represent themes emerging from textual data (King, 2005b). Following King, a prior set of codes (template) was defined, and was modified and added to as texts were read and interpreted. Following King, this study designed an initial template from a loose initial framework and research questions (see details in appendix 3). Throughout the process of conducting fieldwork and analysing the data collected, the final template was developed after the research questions and themes were re-shaped and additional interviews were conducted (see details in appendix 3).

The NVivo 9 software was used in this research to organise the interview transcriptions and generate codes linked to the highlighted texts before performing analysis. The software provides tools to help organise qualitative data, but it cannot do the analysis (Weitzman, 2000). In this research, textual data indexed by codes were retrieved through inquiring codes and cross-codes.

It is worth noting here that the research questions and themes of this study emerged while conducting the fieldwork and analysing the data. Issues of validity are often raised in qualitative case study research. Application of the theory of sampling with ten diverse cases and triangulation of various data sources in this study suggests the conclusions of this research are valid and trustworthy (Manson, 2002).

3.4 An introduction to the case study universities

The ten universities and thirty faculties are selected for the case studies. This section provides some background to the cases by way of introduction. The selected universities are classified into four types of universities, which are public universities, private universities, Rajabhat universities and Rajamangala universities of Technology. The details of cases are presented regarding the types of universities, as follows.

3.4.1 Type One: Public universities

The public universities were formerly called government universities and fully supported by the government. Currently, they are independent as government supported public universities. The three public universities selected are Chulalongkorn University, Silpakorn University and Thammasat University.

3.4.1.1 Chulalongkorn University

Chulalongkorn University comprises eighteen faculties offering programmes that cover a range of arts and sciences, including science and technology, health science, social science and the humanities. In particular, five faculties examined include Engineering, Communication Arts, Architecture, Fine & Applied Arts and Commerce & Accountancy.

Briefly, the Faculty of Engineering offers twelve departments, which are Computer Engineering, Chemical Engineering, Mechanical Engineering, Electrical Engineering, Civil Engineering, Water Resources Engineering, Metallurgical Engineering, Environmental Engineering, Survey Engineering, Mining & Petroleum Engineering, Industrial Engineering and Nuclear Technology.

The Faculty of Communication Arts offers five departments, consisting of Public Relations, Mass Communication, Journalism, Speech Communication & Performing Arts and Motion Pictures & Still Photography.

The Faculty of Architecture offers six departments, including Architecture, Interior Architecture, Urban & Regional Planning, Industrial Design, Landscape Architecture and Housing

The Faculty of Fine & Applied Arts offers four departments, which are Music, Visual Arts, Dance and Creative Arts.

The Faculty of Commerce & Accountancy offers five departments, which are Accounting, Commerce, Banking & Finance, Marketing and Statistics.

3.4.1.2 Silpakorn University

Silpakorn University was originally established as the School of Fine Arts under the Fine Arts Department. Currently, it consists of thirteen faculties, a graduate school and a college that offer programmes covering a range of arts and sciences. Three faculties examined include Decorative Arts, Architecture, and Painting, Sculpture & Graphic Arts.

The Faculty of Decorative Arts contains seven departments, which are Interior Design, Visual Communication Design, Product Design, Applied Arts Studies, Ceramics, Jewelry Design and Fashion Design.

The Faculty of Architecture offers four departments, including Architecture, Architecture & Related Arts, Landscape Architecture and Technical Architecture.

The Faculty of Painting, Sculpture & Graphic Arts provides five departments, which are Fine Arts, Sculpture, Graphic Arts, Thai Arts and Art Theory.

3.4.1.3 Thammasat University

Thammasat University comprises twenty-three faculties, colleges or institutes offering programmes that cover a range of arts and sciences. In particular, two faculties examined include Architecture and Planning, and Fine & Applied Arts.

The Faculty of Architecture & Planning offers five programmes including Architecture, Interior Architecture, Urban Environmental Planning & Development, Landscape Architecture and Architecture for Real Estate Development.

The Faculty of Fine & Applied Arts offers three departments, which are the Department of Textile, Costume, Garment & Fashion Design, the Department of Drama & Industrial Crafts and the Department of Design.

3.4.2 Type Two: Private universities

Private universities are not operated and funded by the government. However, private universities may receive public subsidies, especially in the form of tax breaks and public student loans and grants. The two private universities examined are Bangkok University and Dhurakij Pundit University.

3.4.2.1 Bangkok University

Bangkok University comprises twelve schools, colleges and office offering programmes that cover a range of arts and sciences. In particular, the four faculties examined include Engineering, Communication Arts, Fine & Applied Arts and Business Administration.

Briefly, the School of Engineering offers four departments, which are Electronics & Telecommunications Engineering, Electrical Engineering, Computer Engineering and Multimedia & Internet System Engineering.

The School of Communication Arts offers seven departments, including Public Relations, Journalism, Advertising, Performing Arts, Broadcasting, Film and Brand Communications.

The School of Fine & Applied Arts offers five departments, including Interior Design Management, Visual Arts, Communication Design, Fashion & Textile Design and Product Design.

The School of Business Administration provides seven departments, including Marketing, Finance, Modern Business Management, Human Resource Management, International Business Management, Business Computer and Entrepreneurship.

3.4.2.2 Dhurakij Pundit Universities

Dhurakij Pundit University comprises fifteen faculties, colleges and institutes offering programmes that cover a range of arts and sciences. In particular, four faculties examined include Information Technology, Engineering, Communication Arts, Fine & Applied Arts and Business Administration.

The Faculty of Information Technology offers three departments, which are Business Information Technology, Information Technology and Interactive Design & Game Development.

The Faculty of Engineering provides four departments, including Electrical Engineering, Industrial Engineering, Computer Engineering, Digital Media & Game System Engineering, Energy Management and Communication & Computer Network Engineering.

The Faculty of Communication Arts offers six departments, which are Advertising, Public Relations, Marketing Communication, Radio & Television, Journalism and Film and Digital Media.

The Faculty of Fine & Applied Arts provides four departments, including Applied Performing Arts, Computer Graphic, Interior Design and Fashion Design & Fashion Business.

The Faculty of Business Administration provides eight departments, including Finance, Human Resource Management, Marketing, Management, International Business Management, Industrial Management, Logistics & Supply Chain Management and Tourism Business Management.

3.4.3 Type Three: Rajabhat universities

Rajabhat Universities aim at providing higher education to regional provinces. They were formerly called Rajabhat Institutes and originally emerged as college of education. The two universities examined are Suan Dusit Rajabhat University and Suan Sunandha Rajabhat University.

3.4.3.1 Suan Dusit Rajabhat University

Suan Dusit Rajabhat University comprises eight faculties and schools offering programmes that cover a range of arts and sciences. Two faculties examined are Management Science and Science & Technology.

The Faculty of Management Science provides seven departments, including General Management, Communication Arts, Accounting, Business Administration, Economics, Computer Business and Finance.

The Faculty of Science and Technology offers seven disciplines, which are Computer Science, Information Technology, Environmental & Industrial Management, Safety Science, Cosmetics Science, Environmental Science and Chemistry.

3.4.3.2 Suan Sunandha Rajabhat University

Suan Sunandha Rajabhat University comprises nine faculties and colleges. The programmes cover a range of arts and science. Four selected faculties are Management Science, Fine & Applied Arts, Industrial Technology and Science & Technology.

The Faculty of Management Science offers three disciplines, which are Business Administration, Communication Arts, and Accounting. Particularly, the Department of Business Administration provides seven courses, including Finance & Banking, Marketing, Business Computer, Human Resource Management, International Business Practice, Business Economics and Business Service Management. For the Department of Communication Arts, there are nine courses provided: Journalism, Public Relations, Advertising, Broadcasting, Television, Cinematography, Performing Arts Communication, New Media Broadcasting and Animation & Multimedia.

The Faculty of Fine & Applied Arts offers four departments, including Music, Performing Arts, Design and Fine Arts.

The Faculty of Industrial Technology offers thirteen departments, including Safety Technology and Occupational Health, Industrial Management, Facility Management, Printing Technology, Technology Computer Application in Architecture, Industrial Electrical Technology, Electronics Technology, Graphic & Multimedia Design, Industrial Design, Interior & Exhibition Design, Printing & Packaging Design, Computer Engineering, and Metrology & Quality System.

The Faculty of Science & Technology offers thirteen departments, including Food Industry & Service, Home Economics, Chemistry, Informatics Mathematics, Food Science & Technology, Applied Biology, Environmental Science, Biotechnology, Information Technology, Computer Sciences, Applied Statistics, Aesthetic Sciences & Health, and Applied Thai Traditional Medicine.

3.4.4 Type Four: Rajamangala universities

Rajamangala University of Technology was formerly polytechnic institute system and then renamed to Rajamangala Institute of Technology system before being granted the university status. The three Rajamangala universities are Rajamangala University of Technology Phra Nakhon, Rajamangala University of Technology Rattanakosin and Rajamangala University of Technology Krungthep.

3.4.4.1 Rajamangala University of Technology Phra Nakhon (RMUTP)

RMUTP comprises nine faculties providing programmes that cover a range of arts and science. The two selected faculties are Engineering and Industrial Textiles & Fashion Design.

The Faculty of Engineering offers five programmes for Bachelor of Engineering and three programmes for Bachelor of Industrial Technology. The five programmes for Engineering include Electrical Engineering, Mechanical Engineering, Industrial Engineering, Electronics and Telecommunication Engineering and Computer Engineering. The three programmes for Industrial Technology include Jewelry Molding Technology, Industrial Technology and Mechanical Technology.

The Faculty of Industrial Textiles & Fashion Design offers four programmes including Garment Technology, Textile Chemical Technology, Fashion & Textile Design, and Textile Product Design.

3.4.4.2 Rajamangala University of Technology Rattanakosin (RMUTR)

RMUTR comprises nine faculties and colleges providing a range of arts and science programmes. Two selected faculties are Engineering and Architecture & Design.

The Faculty of Engineering offers seven departments, including Civil Engineering, Telecommunication Engineering, Mechatronics Engineering, Computer Engineering, Instrumental Engineering, Mechanical Engineering and Electrical Engineering.

The Faculty of Architecture & Design provides six departments, which are Interior Architecture, Architectural Technology, Architecture & Urban Design, Construction Management, Industrial Product Design and Communication Art Technology.

3.4.4.3 Rajamangala University of Technology Krungthep (RMUTK)

RMUTK comprises seven faculties that offer a range of art and science programmes. In particular, only one faculty accessed is the Engineering. The Faculty of Engineering provides eight departments, including Construction Management, Mechanical Engineering, Industrial Engineering, Electronics & Telecommunication, Chemical Engineering, Surveying Engineering, Civil Engineering and Electrical Engineering.

3.5 Conclusion

This chapter has introduced the research method that was adopted for the study. It has discussed the operationalisation of the research, and introduced the cases studied. Table 3.2 presents the research questions and main issues investigated.

Table 3.2 Linking research questions and results

Research question	Key investigation	Use of case studies
What are skills that students need to develop to be able to induce innovations?	-Students' skills needed for inducing innovation.	- Contrast - Complement
How do universities nurture students' innovation skills?	-Universities and faculties' perspectives on innovation and its importance for students. -Mechanisms used by universities and faculties to nurture innovation skills.	- Contrast - Complement

Source: Author

Chapter 4

Nurturing innovation skills: A Synthesis of theoretical and empirical investigations

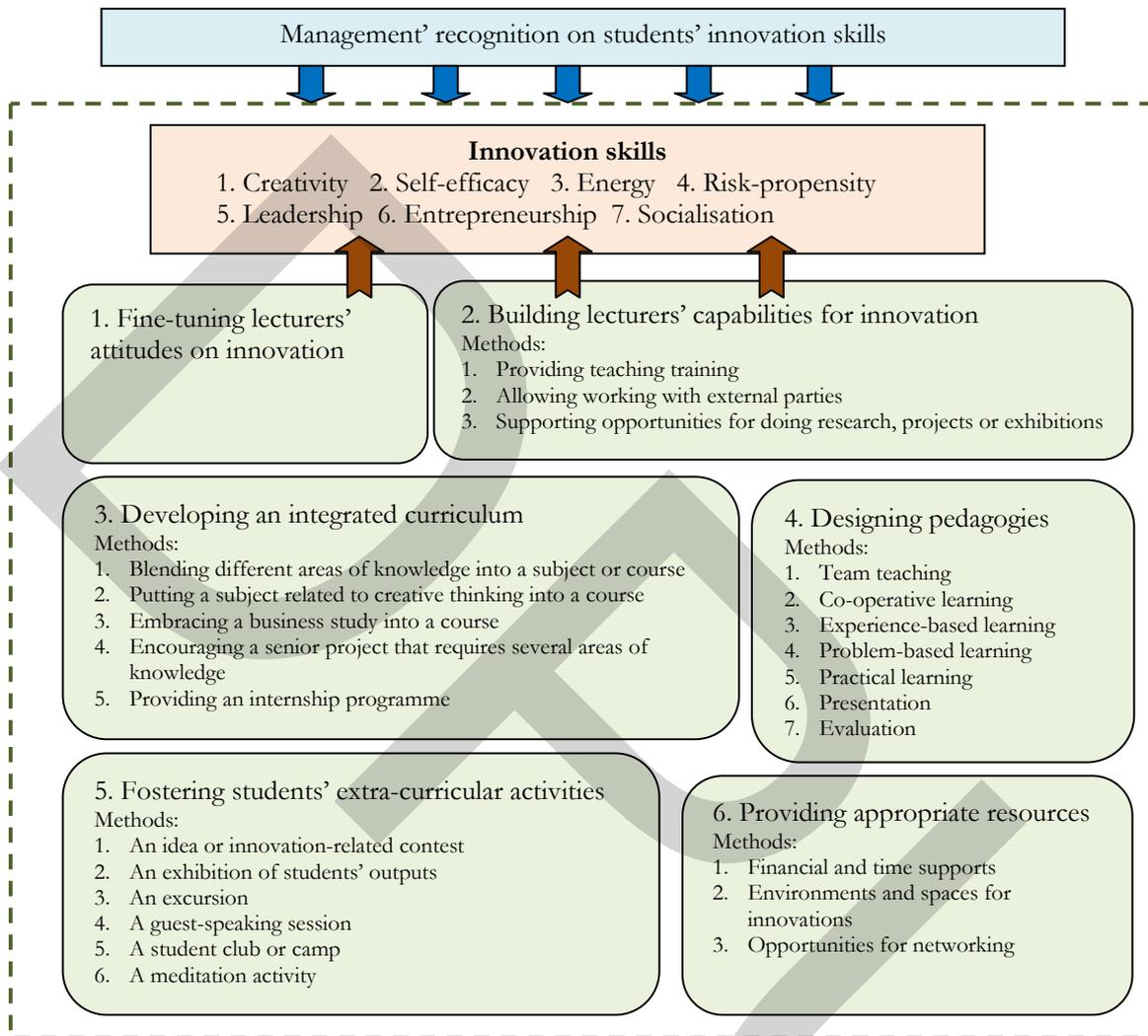
This study explores innovation skills and mechanisms to nurture students' innovation skills at a level of higher education. Innovative graduates have been increasingly required in the Thai creative economy. However, instead of producing innovative graduates, building the creative ones tend to acquire attentions from scholars in an area of education study. Therefore, this research aims to investigate mechanisms that universities and faculties can use to nurture innovation skills of their students who will be innovative graduates in the future.

This chapter comprises seven sections. Section 4.1 shows the modified framework of nurturing innovation skills by the universities and faculties. The details of the framework are explained in Section 4.2 to 4.4. Section 4.2 presents management's views on producing innovative graduates. Section 4.3 describes what innovation skills are. Section 4.4 presents a framework of mechanism for nurturing students' innovation skills. Section 4.5 addresses some difficulties in producing innovative graduates. Some lessons learned are indicated in Section 4.6. Finally, section 4.7 concludes this chapter.

4.1 Nurturing innovation skills: The modified framework

The universities tend to play a supportive role to nurture innovation skills of students; while, the faculties mainly and directly stimulate students to develop those skills. The framework of nurturing innovation skills is constructed based on the empirical findings and existing theories. Figure 4.1 shows the framework of nurturing innovation skills.

Figure 4.1 Nurturing innovation skills: The modified framework



Source: Author, empirical data and theoretical issues

From Figure 4.1, the framework explains innovation skills, and six mechanisms that the universities and faculties use to develop those skills of students. The framework commences with that the management of the faculties and universities have to recognise an importance of innovation and a need to build up innovation skills of students. After that, the framework identifies seven skills needed for innovation, including creativity, self-efficacy, energy, risk-propensity, leadership, entrepreneurship and socialisation. Those innovation skills can be nurtured through six mechanisms, including 1) fine-tuning lecturers' attitudes on innovation, 2) building lecturers' capabilities for innovation, 3) developing integrated curriculum, 4) designing pedagogies, 5) fostering students' extra-curricular activities, and 6) providing appropriate resources.

The next three sections explain three main elements in the framework, commencing with the management's views on producing innovative graduates (in Section 4.2), innovation skills (in Section 4.3), and mechanisms used to nurture innovation skills (in Section 4.4), respectively. The presentation of this chapter is thematic. In each section, the argument is discussed and followed by extracted evidence from representative universities of public universities, private universities, Rajabhat universities and Rajamangala universities of Technology, consecutively. The (modified) framework was constructed based on complementary findings from fieldwork in the ten universities in the four different groups. The four diverse groups of universities actually provide similar results.

4.2 Management's views on producing innovative graduates

4.2.1 Management's recognition on an importance of innovation

Innovation is perceived, by the management of the faculties examined, as an important driver to the future careers of students in the creative faculties¹. While creativity has long been embedded in the creative disciplines, innovation should be added to students' skills to drive the creative economy. As innovation occurs when new ideas are transformed into new products or services that can be commercialised or widely used (Tidd et al., 2001, Rogers, 2003), innovation has been typically considered by and embedded in the creative disciplines. Some examples of evidence from the representative universities of public universities, private universities, Rajabhat universities and Rajamangala universities of Technology are presented respectively as below.

Innovation is the nature of our [Fine & Applied Arts] discipline. We [the faculty members and students] must create new outputs such as new product designs (in the department of Creative Arts), new styles of Traditional Thai dancing (in the department of Dance) or new lyrics and rhythms (in the department of Music). Such new outputs should be commercialised or demonstrated for other people. (The Dean of Fine & Applied Arts/ Chulalongkorn University/ 3 June 2011)

Our [Architecture] faculty focuses on innovation and social responsibility. Basically, students have to create and design new products that can solve social problems. For examples, a group

¹ Interviewed with the Dean of Fine & Applied Arts at Chulalongkorn University; the Deans of Engineering, Fine & Applied Arts at Bangkok University; the Deans of IT, Communication Arts, Business Administration at Dhurakij Pundit University; the Dean of Science & Technology at Suan Dusit Rajabhat University; the Dean of Industrial Textiles & Fashion Design at RMUTP; the Dean of Architecture at RMUTR.

of students turns local materials in a community to create new products for that particular community. (The Dean of Architecture & Planning/ Thammasat University/ 8 June 2011)

Students studying Communication Arts have to develop creativity and innovation capabilities because they have to come up with ideas and presentations that can attract audiences. (The Dean of Communication Arts/Dhurakij Pundit University/ 13 May 2011)

Innovation is significant to our lecturers and students. Our [Science & Technology] discipline is a research-based field underlying innovation. (The Dean of Science & Technology/ Suan Sunandha Rajabhat University/21 June 2011)

In the career of Industrial Textiles & Fashion Design, students have to be creative and innovative since they have to deal with new materials, technologies, operating processes, and new designs of textile products that can be sold. Currently, textile companies and factories have high demands for this kind of workforce. (The Dean of Industrial Textiles & Fashion Design/ Rajamangala University of Technology Phra Nakhon/ 26 July 2011)

Table 4.1 presents more evidence supporting that innovation is embedded in the creative disciplines.

Table 4.1 Extracted evidence of embeddedness of innovation in the creative disciplines

Creative discipline	Statement showing embeddedness of innovation (Example)	Faculty/University (Example)
Engineering	Creativity and entrepreneurship necessitate innovation in engineering.	Engineering/Bangkok University
Computer Sciences	Combining design and technology leads to innovation for IT nowadays.	Information Technology/ Dhurakij Pundit University; Science & Technology/Suan Dusit Rajabhat University
Communication Arts	Innovative thinking is essential to this area.	Communication Arts/ Chulalongkorn University and Dhurakij Pundit University
Architecture	New designs of products and new solutions of problems are required in the architecture study.	Architecture/Silpakorn University, Thammasat University, Rajamangala University of Technology Rattanakosin
Fine & Applied Arts	Innovation is the nature of Fine & Applied Arts.	Fine & Applied Arts/ Chulalongkorn University, Thammasat University
Business	Innovative thinking (integrated from various fields) enables new opportunities for business.	Business Administration/ Bangkok University, Dhurakij Pundit University

Source: Author, empirical data

From the empirical data, the management of the faculties recognise that commercialisation of creativity, as an important part of innovation, ensures competitive advantages in the competitive market. Importantly, the universities and faculties can nurture students' skills needed for innovations, which is consistent to that innovation skills can be developed through the formal education system (Chell and Athayde, 2009). Bangkok University, as an exemplar, attempts to simulate innovation based on commercialisation of new ideas. While the university organises to facilitate new ideas across many faculties, it establishes Bangkok University Creative Centre (BUCC) to demonstrate and commercialise students' innovations. As a consequence, students are trained to capitalise on both creativity and commercialisation to induce innovation². More examples of evidence are presented below, regarding public universities, private universities, Rajabhat universities and Rajamangala universities of Technology.

To create new designs of products that can be sold, students have to conduct research on customer needs and market trends so as to produce new products that meet customer satisfactions. (The Dean of Fine & Applied Arts/ Thammasat University/ 21 July 2011)

Bangkok University facilitates students to combine creativity and entrepreneurship to launch new products through the Bangkok University Creative Centre (BUCC). (The Dean of Engineering / Bangkok University/ 8 June 2011)

Students studying at the Department of Industrial Design are required to attend a business course related to small business management. This is because the faculty expects students to produce new product designs that can be commercialised. (The Deputy Dean of Industrial Technology/ Suan Sunandha Rajabhat University/ 3 August 2011)

We [the faculty of Architecture] focus on design and technology. Products or outputs from the architecture discipline have to be commercialised. (The Dean of Architecture & Design/ RMUTR/ 19 July 2011)

4.2.2 Management's intention on building innovation skills

Despite of an importance of innovation for the creative disciplines, not all of faculties intend to nurture innovation skills to their students. Some faculties intend to nurture students' innovation skills because students' performances (e.g. winning the contest, inducing high-quality and innovative projects and high employment rate) assist the faculties earn reputation and transfer new knowledge

² Interviewed with the Deputy Dean of Engineering and the Dean of Fine & Applied Arts at Chulalongkorn University; the Deans of Decorative Arts and Architecture at Silpakorn University; the Dean of Engineering at Bangkok University; the Dean of IT at Dhurakij Pundit University; the Dean of Science & Technology at Suan Dusit Rajabhat University; the Dean of Industrial Textiles & Fashion Design at RMUTP; the Deans of Architecture & Design and Engineering at RMUTR.

to wider communities. For example, the Faculty of Architecture, Thammasat University, combines the concept of innovation and social responsibility, thereby focusing on searching new ways to address social needs. The Faculty of Fine & Applied Arts at the same university mentions that innovation skills developed during undergraduate years increase employment and business opportunities for the students in the future.

However, some other faculties reveal that developing innovation skills is not the ultimate objective of their educations. Two main reasons occur. Firstly, some faculties aim to provide basic knowledge to their students to meet with quality and requirements of their professional careers; meanwhile, building students' innovation skills is additional. For example, the Engineering faculties (in Chulalongkorn University and Dhurakij Pundit University) and the Faculty of Science & Technology (in Suan Sunandha Rajabhat University) intend to ensure quality of students in terms of basic knowledge before nurturing innovation skills. In particular, in the Faculty of Painting, Sculpture & Graphic Arts, Silpakorn University, students must create fine arts that enhance human spirits and mindsets while commercialisation is not the core. However, fine arts can be applied and extended into commercialised products later on.

Secondly, limitations of nurturing innovation skills occur, in some cases; therefore, some faculties intend to focus on only basic and technical knowledge. Low quality of prospective students (especially in the faculties that have to accept all applicants), and limited credits and timeframe of the curriculum require the faculties to provide basic knowledge and skills needed for routine works as the priority³. Innovation skill is a higher-level skill that students can develop by themselves after finishing their bachelor degrees⁴.

4.3 Innovation skills

The empirical evidence presents that skills needed for innovation encompass creativity, self-efficacy, energy, risk-propensity, leadership, entrepreneurship and socialisation. The findings are consonant

³ Interviewed with the Dean of Communication Arts at Dhurakij Pundit University; the Dean of Science & Technology at Suan Dusit Rajabhat University; the Dean of Engineering at RMUTP; the Deans of Architecture & Design and Engineering at RMUTR; the Dean of Engineering at RMUTK.

⁴ Interviewed with the Dean of Engineering at RMUTK.

with the notion that skills needed for innovations can include creativity, self-efficacy, energy, risk-propensity and leadership (Chell and Athayde, 2009, NESTA, 2008). In addition, the empirical evidence also suggests that entrepreneurship and socialisation can foster innovation. Entrepreneurship urges students to find opportunities and take risk in the commercial market (NESTA, 2008). Socialisation necessitates trust, articulation, sharing and exchanging variously dissimilar knowledge among different actors to attain successive adjustment, adaptation and innovation, as suggested by Bathelt, Malmberg, & Maskell (2004).

Firstly, the evidence shows that creativity enables students to initiate their projects. According to Chell and Athayde (2009), students have to use their imagination, connect ideas and tackle and solve problems and curiosity. For example, the architecture students have to imagine and create new product designs⁵. The Fine & Applied Arts students have to set problems and find solutions in order to come up with a new product design⁶.

Secondly, to induce senior projects or work pieces for the contests, self-efficacy is important. Students need to develop self beliefs, self awareness and social confidence. They need to be confident when they express their ideas through their outputs (e.g. art works or robots). Especially, social confidence drives students to discuss and negotiate with team members to find solutions or agreed ideas for their particular projects⁷. For example, students in the Fine & Applied Arts need to develop confidence to create their art works and new designs with their own identities⁸. To create and present a play, a music concert or a robot for a competition, students cannot perform solely but they need to collaborate with team members and express ideas to yield such innovation⁹.

⁵ Interviewed with the Deans of Architecture at Chulalongkorn University and Silpakorn University; the Dean of Architecture & Planning at Thammasat University; the Dean of Architecture & Design at RMUTR.

⁶ Interviewed with the Deans of Fine & Applied Arts at Chulalongkorn University, Thammasat University, Bangkok University, Dhurakij Pundit University; the Dean of Painting, Sculpture & Graphic Arts at Silpakorn University; the Dean of Fine Arts at Suan Sunandha Rajabhat University.

⁷ Interviewed with the Deans of Fine & Applied Arts at Chulalongkorn University and Thammasat University; the Dean of Architecture at Silpakorn University; the Deans of Engineering at Chulalongkorn University, Dhurakij Pundit University, RMUTP and RMUTR.

⁸ Interviewed with the Deans of Fine & Applied Arts at Chulalongkorn University, Thammasat University, Bangkok University and Dhurakij Pundit University; the Dean of Fine Arts at Suan Sunandha Rajabhat University.

⁹ Interviewed with the Deans of Fine & Applied Arts at Chulalongkorn University and Thammasat University; the Deans of Engineering at Chulalongkorn University, Bangkok University, Dhurakij Pundit University, RMUTP and RMUTR.

Thirdly, students who are full of energy tend to put efforts and enthusiasm to create and complete their projects. Basically, students in the creative faculties have to conduct projects to show their performances. Throughout a process of project development, especially the senior project, students have to commit and persist to do, correct and re-do their tasks until they achieve the final outputs¹⁰.

Fourthly, for risk-propensity, the empirical data reveals that students have to be able to tolerate uncertainties to a certain degree when they create their new projects or pieces of works. Through learning from trial-and-error, students have to take risk of failure, at some degree, in order to complete their projects¹¹ or scientific experiments¹². After their performances are evaluated by lecturers, the students may have to correct and re-do their projects¹³.

Fifthly, students who have leadership skill tend to encompass vision and the ability to mobilise commitment. For example, to join the contests or conduct the senior projects, students need to plan ahead and work together to achieve the tasks¹⁴. Moreover, the Dean of Architecture at Chulalongkorn University indicated that students needed to think of futuristic trends, and turned ideas into visible outputs.

Sixthly, students need skill of entrepreneurship if they want their outputs to be commercialised. They have to be able to seek opportunities of creating new products that can be sold in the market when they commence their projects. Not only they conduct research on the histories related to their projects, but also they study market trends, customer behaviour and satisfaction¹⁵. Particularly, at the end of the final year of study, students in the creative faculties have to present their senior projects

¹⁰ Interviewed with the Deans of Fine & Applied Arts, Engineering and Architecture at Chulalongkorn University; the Deans of Decorative Arts and Painting, Sculpture & Graphic Arts at Silpakorn University; the Dean of Engineering at Bangkok University; the Deans of Engineering and IT at Dhurakij Pundit University; the Dean of Science & Technology at Suan Dusit Rajabhat University; the Dean of Fine Arts at Suan Sunandha Rajabhat University; the Dean of Industrial Textiles & Fashion Design at RMUTP; the Dean of Architecture & Design at RMUTR.

¹¹ Interviewed with the Deans of all faculties examined.

¹² Interviewed with the Dean of Science & Technology at Suan Dusit Rajabhat University.

¹³ Interviewed with the Deans of all faculties examined.

¹⁴ Interviewed with the Dean of Fine & Applied Arts, Engineering; the Dean of Engineering at Bangkok University; the Deans of Engineering and IT at Dhurakij Pundit University; the Dean of Science & Technology at Suan Dusit Rajabhat University; the Dean of Fine Arts at Suan Sunandha Rajabhat University; the Dean of Industrial Textiles & Fashion Design at RMUTP.

¹⁵ Interviewed with the Dean of Architecture at Chulalongkorn University; the Dean of Engineering at Bangkok University; the Deans of Engineering and IT at Dhurakij Pundit University; the Dean of Industrial Textiles & Fashion Design at RMUTP; the Dean of Architecture & Design at RMUTR.

to publics and companies¹⁶. The projects having potentials for commercialisation and their owners may acquire attentions from companies. Even some work pieces may be sold. For example, the Faculty of Industrial Technology, Suan Sunandha Rajabhat University, expects students to conduct research and come up with new product designs that can be sold. Moreover, some projects – such as games, software programmes, new furniture designs and fashion designs – that are developed based on market opportunities are likely to catch attentions from audiences and companies.

Finally, for socialisation, students need to express, share and articulate ideas with team members when they develop projects. For example, students from different engineering fields collaborate to create a robot to take part in the World Robocup Competition. They cannot avoid articulating ideas to yield successive adjustments of the robot¹⁷. In addition, a team of SIFE at Chulalongkorn University consists of students from different disciplines (e.g. business and communication arts) to learn, exchange and experiment ideas to create a community project for the Students in Free Enterprise (SIFE) competition. They established a SIFE club and connect with members via social networks.

4.4 Mechanisms driving innovation skills

Innovation skills can be learned, as mentioned in section 4.1. The empirical evidence demonstrates that the faculties can nurture students' innovation skills through six mechanisms, including 1) fine-tuning lecturers' attitudes on innovation, 2) building lecturers' capabilities for innovation, 3) developing integrated curriculum, 4) designing pedagogies, 5) fostering students' extra-curricular activities, and 6) providing appropriate resources.

4.4.1 Fine-tuning lecturers' attitudes on innovation

Fine-tuning attitudes on innovation can ensure that lecturers have sufficient understandings on innovation and an importance of innovation so that they can urge students to induce innovation. The Deans of Information Technology (at Dhurakij Pundit University), of Fine & Applied Arts (at Bangkok University) and of Management Science (at Suan Sunandha Rajabhat University) indicated

¹⁶ Interviewed with the Deans of all faculties examined.

¹⁷ Interviewed with the Deputy Dean of Engineering at Chulalongkorn University; the Deans of Engineering at Bangkok University, Dhurakij Pundit University, RMUTP and RMUTR.

that it was important that lecturers needed to have the positive attitudes toward innovation. The finding is consistent with the notion that lecturers have to understand an importance and the concept of innovation before being able to coach guide and inspire students' new ideas (Chell and Athayde, 2009). For example, the Dean of Architecture at Thammasat University explained that the lecturers who understood the concept of innovation would provide assignments and indicate evaluation criteria that foster innovations. The Faculty of Communication Arts, Bangkok University, attempts to understand the meaning of creativity and its relationship with innovation. In addition, faculty members in the Faculty of Science & Technology, Suan Dusit Rajabhat University, have to be in line with a policy that they should train students to be creative, analytical and problem-solving.

4.4.2 Building lecturers' capabilities

Building lecturers' capabilities can ensure students' innovation skills to a certain degree. In a process of learning, lecturers and students directly interact with each other. Lecturers transfer not only basic knowledge but also experiences and tacit knowledge to students. Importantly, they encourage students to develop innovation skills via the process of knowledge transferring. Therefore, intelligent and dedicated lecturers are in need¹⁸. For example, lecturers in the Faculty of Fine & Applied Arts (at Bangkok University), the Faculty of Communication Arts (at Dhurakij Pundit University), and the Faculty of Science & Technology (at Suan Sunandha Rajabhat University) give advice to their students in creating senior projects. Similarly, lecturers in the Faculty of Engineering at Dhurakij Pundit University coached the student project for competing in the Thailand Embedded Product Award (TEPA) contest. Particularly, lecturers in the Faculty of Management Science at Suan Dusit Rajabhat University coached a team of students to come up with the project that created a rubber-tapping tool made from Durian shell for the competition.

The evidence explicates that the faculties can strengthen lecturers' capabilities by 1) providing teaching training, 2) allowing working with external parties and 3) supporting opportunities for researching, doing projects and joining exhibitions.

Firstly, all faculties require lecturers to pursue further education (i.e. levels of master degree and doctoral degree). Especially, lecturers with a doctoral degree and academic positions are required¹⁹.

¹⁸ Interviewed with the Dean of Communication Arts at Dhurakij Pundit University.

¹⁹ Interviewed with the Dean of Architecture & Design at RMU/TR.

In addition, research training is provided for lecturers in some places such as at the Faculty of Architecture, Thammasat University, and at Dhurakij Pundit University. Short-training courses such as IT, English or specialisation are encouraged in all faculties. After being trained, lecturers should transfer knowledge to students and other faculty members. For example, the Dean of Fine & Applied Arts at Suan Sunandha Rajabhat University mentioned that lecturers had to use knowledge from training to improve or create a course. In addition, lecturers have to attend teaching-technique training so as to be able to educate and communicate with students. The examples of universities that provide such training for their lecturers include Chulalongkorn University²⁰, Dhurakij Pundit University²¹, Bangkok University²² and Suan Dusit Rajabhat University²³. In particular, the Engineering Faculty, Chulalongkorn University, arranges a training programme called 'Effective Teaching' for its faculty members. This training session portrays ways that lecturers can stimulate students' thinking.

Secondly, the faculties allow their lecturers to work with external organisations. The empirical data shows that all faculties recognise that environments outside the universities have been rapidly changed. Lecturers can keep up with the changing environments and new trends in the areas of their expertise and professions when they co-work with outsiders²⁴. Experiences and practical knowledge would be transferred to students²⁵. For example, the Faculty of Fine & Applied Arts, Chulalongkorn University, has a policy to stimulate lecturers to work outside the university because lecturers need to keep up with and compare with other people's competencies in the same field of expertise. The Faculty of Communication Arts, Dhurakij Pundit University, allows their lecturers to take sabbatical leave to conduct a research for three months during summer. Also, the Department of Communication Arts in the Faculty of Management Science, Suan Sunandha Rajabhat University, allowed two lecturers to stay and work with a production team of 'the Legend of King Naresuan' film for six months.

²⁰ Interviewed with the Dean of Fine & Applied Arts at Chulalongkorn University.

²¹ Interviewed with the Dean of Engineering at Dhurakij Pundit University.

²² Interviewed with the Dean of Engineering at Bangkok University.

²³ Interviewed with the Deans of Science & Technology and Communication Arts at Suan Dusit Rajabhat University.

²⁴ Interviewed with the Dean of Decorative Arts at Silpakorn University; the Dean of Fine & Applied Arts at Thammasat University; the Deans of Communication Arts at Dhurakij Pundit University, Suan Dusit Rajabhat University and Suan Sunandha Rajabhat University; the Dean of Engineering at RMUTP and RMUTR.

²⁵ Interviewed with the Dean of Communication Arts at Dhurakij Pundit University; the Dean of Industrial Textiles & Fashion Design at RMUTP.

Lastly, the faculties support lecturers to conduct research, set up projects or hold exhibitions. Through doing researches and projects, lecturers tend to create new knowledge, inventions and occasionally innovations²⁶. In particular, the Faculty of Painting, Sculpture & Graphic Arts, Silpakorn University, hold an annual exhibition for its lecturers to create and show their art works; as a consequence, lecturers can enhance their expertise and professional skills. Students would benefit in two ways: a transfer of knowledge from lecturers to students, and students' participations in conducting researches or projects. Especially, both lecturers and students can practically learn from the projects or researches that are collaborated between the faculty members and external parties. For example, in the Architecture faculties at Silpakorn University, Chulalongkorn University, Thammasat University and Rajamangala University of Technology Rattanakosin, and the Engineering faculties at Bangkok University and Rajamangala University of Technology Phra Nakhon, students are allowed to take part in the projects collaborated with external organisations led by their lecturers. Furthermore, a group of lecturers in the Painting, Sculpture & Graphic Arts, Silpakorn University, embraced their students to join the project of sandstone sculpture focusing on a new design of carving²⁷. The lecturer in the Engineering Faculty, Bangkok University, hired students to be assistants in the Robot project co-working with the MK restaurant. The faculty members in the Faculty of Industrial Textiles & Fashion Design, Rajamangala University of Technology Phra Nakhon, hired students to help with producing costumes from water hyacinth for the national contest.

4.4.3 Developing an integrated curriculum

For the third mechanism, the empirical data show that a curriculum that is multi-disciplinary tends to stimulate innovation skills, as mentioned by Thursby, Fuller, & Thursby (2009). Integration of knowledge, thoughts and expertise from different areas generates not only new ideas but also potentials for commercialisation²⁸. Students benefit from the integrated curriculum in two ways. Firstly, students exploit multi-disciplinary knowledge to induce innovations²⁹. The findings confirm that students can develop innovation skills when they capitalise on diverse aspects and ideas (Boni et al., 2009). Secondly, students' socialisation skills are developed and enhanced because students have

²⁶ Interviewed with the Dean of Management Science at Suan Dusit Rajabhat University.

²⁷ Interviewed with the Dean of Painting, Sculpture & Graphic Arts at Silpakorn University.

²⁸ Interviewed with the Deputy Dean of Engineering at Chulalongkorn University.

²⁹ Interviewed with the Dean of Business Administration at Dhurakij Pundit University.

a chance to connect and communicate with other students from different fields of study³⁰. Importantly, the curriculum has to evolve over time³¹.

From the empirical evidence, the faculties can establish the integrated curriculum by 1) blending different areas of knowledge into a subject or course, 2) putting a subject related to creative thinking into a course, 3) embracing a business study into a course, 4) encouraging a senior project that requires several areas of knowledge, and 5) providing an internship programme.

Firstly, an integration of different areas of knowledge into a subject or a course equips students with several areas of knowledge, which is necessary to induce innovations. In addition, working with students from other departments or faculties broadens students' views; as well as, enhances students' socialisation and collective-learning skills. The Dean of Communication Arts at Chulalongkorn University suggested that the university should set up a registration system that allows and facilitates students to enrol on subjects across disciplines. For example, the Faculty of Engineering, Chulalongkorn University, assists students to integrate twelve fields of engineering knowledge through a new subject, namely "Exploring Engineering World", for all first-year students so that the students can portray the whole picture of engineering. Moreover, the first-year students from different departments in the faculty of Engineering learn some core subjects together, which leads to collective learning and sharing across disciplines. In addition, the Faculty of Communication Arts, Chulalongkorn University, provides subjects from other faculties (e.g. Design from the Faculty of Architecture, Marketing from the Faculty of Commerce & Accountancy, Arts Application from the Faculty of Fine & Applied Arts) for its students so that students have a broad perspective. For the Faculty of Business Administration, Bangkok University, the Marketing Department collaborates with the faculties of Fine & Applied Arts, Communication Arts and Laws to produce creative products for the Dummy Company subject. Interestingly, the Communication Arts Department at the Faculty of Management Science, Suan Sunandha Rajabhat University, set up one students' project that exploits knowledge from four subjects (i.e. Scriptwriting, Directing, Filmmaking and Editing) to make a short movie. The final evaluation of the project occurs simultaneously when students present their movies to a panel of four lecturers and external judges. Furthermore, the Faculty of Industrial Textiles & Fashion Design, Rajamangala University of Technology Phra

³⁰ Interviewed with the Deputy Dean of Engineering at Chulalongkorn University.

³¹ Interviewed with the Deputy Dean of Engineering at Chulalongkorn University; the Dean of Fine & Applied Arts at Thammasat University; the Dean of Management Science at Suan Sunandha Rajabhat University.

Nakon, creates a new course that combines business and textile studies, according to high demand for textiles students who have knowledge of merchandising.

Secondly, the faculties can enhance students' creative thinking by embedding the creative thinking subject into the existing course. For example, all faculties in Bangkok University are required to put the subject of Creativity into their courses, but they are allowed to adjust the Creativity subject to fit with their identities³². In addition, the faculties of Management Science and Fine Arts, Suan Sunandha Rajabhat University, add the Creative Thinking 1 and the Creative Thinking 2 into the Communication Arts³³ and Fine Arts courses³⁴. The findings support that design and arts should be combined into the curriculum in order to enhance students' innovation skills (Sudmails, 2007, Boni et al., 2009, Brown, 2008).

Thirdly, business study is embedded into courses in some creative faculties. That leads to development of ability for commercialisation³⁵. The finding is consistent with CCI (2007)' notion that training on business and entrepreneurship is emphasised in higher education courses in the arts and design. Commercialisation of creative outputs is an important part of students' innovation (Boni et al., 2009, Radcliffe, 2005, Thursby et al., 2009). For example, the Faculty of Fine & Applied Arts, Thammasat University, teaches students about business through the Presentation and Arts Management subjects. However, students still need to study more about business and accounting³⁶. The Faculty of Decorative Arts, Silpakorn University, requires students to learn Management for 3 credits in the final year of undergraduate study, with an aim that students can find business opportunities for their creative theses. The Dean of Architecture at Silpakorn University mentioned that the students needed skills of business and entrepreneurship to establish a company and sell art works; as a consequence, the faculty invited guest speakers to share experience of doing business. The Faculty of Industrial Technology, Suan Sunandha Rajabhat University, provides one business subject called "Small Business Management" (3 credits) for its students. In addition, the Faculty of Architecture & Design, Rajamangala University of Technology Rattanakosin, requires students to learn the "Customer Behaviors" subject in order to conduct research on customer satisfaction for

³² Interviewed with the Deans of Communication Arts, Engineering and Fine & Applied Arts at Bangkok University.

³³ Interviewed with the Dean of Management Science at Suan Sunandha Rajabhat University.

³⁴ Interviewed with the Dean of Fine & Applied Arts at Suan Sunandha Rajabhat University.

³⁵ Interviewed with the Dean of Business Administration at Dhurakij Pundit University.

³⁶ Interviewed with the Dean of Fine & Applied Arts at Thammasat University.

their creative products. The Faculty of Engineering, Rajamangala University of Technology Rattanakosin, provides the Entrepreneurship subject and the Modern Management subject for their students, with an aim that their students will be entrepreneurs in the future. Moreover, the Faculty of Science & Technology, Suan Dusit Rajabhat University, requests its students in the Departments of Information Technology and Cosmetics to study a marketing subject. The evidence is consistent with the notion that students in scientific disciplines are lack of skills in management, communication and team-based problem solving which are critical to decision making in innovation-related careers (Thursby et al., 2009).

Fourthly, encouraging a senior project that requires several areas of knowledge can generate innovations³⁷. The empirical evidence confirms that cross-disciplinary projects can facilitate students to induce innovation (Chell and Athayde, 2009). The Deans of Engineering faculties at Bangkok University and Dhurakij Pundit University indicated that students worked on their senior projects based on various types of knowledge and expertise. The findings show that the disciplines of Engineering, Architecture, Fine & Applied Arts and Science & Technology require students to conduct senior projects at the final year of study as a compulsory condition to graduate³⁸. Students can integrate all areas of knowledge learned in the previous years and internship experiences to create and complete their senior projects. Importantly, they can either design their senior projects by themselves or ask for advice from lecturers. Throughout a process of conducting the senior project, students learn by trial-and-error to pass each step in the process since they have to try several methods to fulfill requirement of each step. Failing the project evaluation results in re-thinking and repeating which eventually leads to learning, self confidence and risk taking. For example, at the fourth year of study, a group of students in the Music Department of Fine & Applied Arts Faculty, Chulalongkorn University, has to compose Thai music and arrange a show to demonstrate the music to publics before finishing the degree. Moreover, the Faculty of Decorative Arts, Silpakorn University, requires students to create an art work as an individual thesis in order to graduate. The

³⁷ Interviewed with the Dean of Fine & Applied Arts at Chulalongkorn University; the Dean of Engineering at Bangkok University.

³⁸ Interviewed with the Deans of Fine & Applied Arts, Engineering and Architecture at Chulalongkorn University; the Deans of Decorative Arts and Painting, Sculpture & Graphic Arts at Silpakorn University; the Deans of Engineering and Business Administration at Bangkok University; the Deans of Engineering and IT at Dhurakij Pundit University; the Dean of Science & Technology Faculty at Suan Dusit Rajabhat University; the Dean of Fine Arts at Suan Sunandha Rajabhat University; the Dean of Industrial Textiles & Fashion Design at RMUTP; the Dean of Architecture & Design at RMUTR.

Faculty of Fine Arts, Suan Sunandha Rajabhat University, requires the Fashion students to design seven fashionable costumes as their senior projects.

Finally, an internship programme is necessary to students³⁹. Students have opportunities to apply different lessons learned in classes to work in companies. Students are trained to do tasks and solve problems at work. The broad views and knowledge from the companies are combined into existing knowledge from the universities. New ideas can occur and working skills are developed. Occasionally, students capitalise on internship experiences to initiate their final projects⁴⁰.

It is worth noting that an establishment of the integrated curriculum requires collaborations from other faculties in the university, especially from a business discipline. However, the evidence shows that collaboration tends to be informal since the management tends to skip a complex formal process. The faculty establishes the integrative curriculum and informally asks other related faculties to design a subject and provide a lecturer for that particular subject. For example, the Faculty of Communication Arts, Chulalongkorn University, asks other faculties to provide the particular subjects for its students through informal and interpersonal connections. The Faculty of Engineering, Rajamangala University of Technology Rattanakosin, asks the Faculty of Business Administration to teach the “Business Plan” to its students.

4.4.4 Designing pedagogies

The fourth mechanism, designing pedagogies, to facilitate innovation skills is necessary. The creative faculties employ the concept of student-centered learning to engender skills that are important to creativity and innovation. Student-centered learning gives autonomy to students to discover their own learning styles, to understand their motivation and to acquire effective study skills (Estes, 2004). The evidence shows that, to put the student-centered learning into practice, lecturers play the important roles to use and design appropriate pedagogies. The lecturers tend to help students set achievable goals, encourage students to improve their potentials and identities, help them to work

³⁹ Interviewed with the Deans of Engineering and Communication Arts at Chulalongkorn University; the Dean of Fine & Applied Arts at Thammasat University; the Dean of Engineering at Bangkok University; the Dean of Communication Arts at Dhurakij Pundit University; the Dean of Science & Technology at Suan Dusit Rajabhat University; the Dean of Industrial Textiles & Fashion Design at RMUTP; the Deans of Architecture & Design and Engineering at RMUTR; the Dean of Engineering at RMUTK.

⁴⁰ Interviewed with the Dean of Commerce & Accountancy at Chulalongkorn University; the Dean of Communication Arts at Dhurakij Pundit University; the Deans of Architecture & Design and Engineering at RMUTR; the Dean of Engineering at RMUTK.

co-operatively in groups and ensure that they know how to exploit all the available resources for learning⁴¹. The Dean of Architecture at Chulalongkorn University emphasised that students were the ones who think, do, present and modify their own works; meanwhile, lecturers listened to and commented on students' works. The lecturers play roles to support and oppose the ideas of students, with an aim for students' improvement. In addition, in the Painting, Sculpture & Graphic Arts, Silpakorn University, lecturers tend to inspire and gear students to reach the students' own identities. Similarly, the Dean of Fine Arts at Suan Sunandha Rajabhat University mentioned that lecturers had to help students find inspiration to initiate art works. The findings are consistent with that lecturers are the ones who stimulate the students' projects, learning process and open-mindedness to foster students' ideas (Mustar, 2009, Chell and Athayde, 2009).

From the evidence, innovation skills are stimulated by seven pedagogies through students' seminar activities, research, projects (or assignments). Seven pedagogies include 1) team teaching, 2) co-operative learning, 3) experience-based learning, 4) problem-based learning, 5) practical learning, 6) presentation and 7) evaluation.

Before discussing seven pedagogies, seminar activities, research and projects (or assignments) are portrayed. The empirical evidence confirms that assignments, class work and projects stimulate students to express their innovative behaviours (Chell and Athayde, 2009). At first, all the faculties provide a seminar class where the final-year students have to work collectively and learn how to assess and criticise the works of themselves and their peers⁴². For example, the Dean of Architecture & Design at Rajamangala University of Technology Rattanakosin explained that an architect could not create projects alone; therefore, the students in this faculty had to practice criticising, discussing and presenting in the seminar class.

At second, for researching, the faculties of science studies require students to conduct research as conducting research is a scientific way of finding new knowledge⁴³. In addition, the arts students have to conduct research so as to use the findings as backgrounds of their art works⁴⁴. For example, students in the Architecture & Design, Rajamangala University of Technology Rattanakosin, have to

⁴¹ Interviewed with the Deans of all faculties examined.

⁴² Interviewed with the Deans of all faculties examined.

⁴³ Interviewed with the Deans of all faculties that provide education in science.

⁴⁴ Interviewed with the Dean of Fine & Applied Arts at Thammasat University.

search for related information, study historical backgrounds of topics and do some experiments in order to design and create new architectural outputs.

At last, for some subjects, the lecturers demand and encourage students to set up projects or do assignments⁴⁵. Building projects allows students to integrate knowledge from various subjects and fields of study. For example, in the Faculty of Engineering, Bangkok University, students have to create projects such as an invention of microprocessors or of robots. Students can either select topics of their interests or follow the lecturers' selection. Especially, students learn collectively and co-operatively when they are assigned to work on a group project or assignment.

As mentioned previously, there are seven pedagogies used to facilitate innovation skills via doing the seminar activities, researches and projects (or assignments). At first, team-teaching by a group of lecturers leads to a mixture of different thoughts and experiences in a class. Students can learn from dissimilar points of views and various role models in order to create their own identities⁴⁶. In addition, this method ensures that grading is fair as students' performances are evaluated by a group of lecturers. For example, in the Faculty of Architecture, Silpakorn University, students have to balance different comments from a group of lecturers – that combine lectures with utmost imagination, and those with practical creations – on their projects. In addition, the Faculty of Painting, Sculpture & Graphic Arts at the same university provides a team of teachers (approximately five persons) to teach and give criticisms to the art works of the fourth and fifth-year students. The findings are consonant with the statement that team-teaching integrates diverse knowledge of different lecturers so that students can learn from different perspectives (Kay et al., 1998).

At second, for co-operative learning, students are asked to work as a team to create a group project. Students learn how to articulate, discuss, negotiate, argue and assess ideas with group members to complete the projects⁴⁷; therefore, creativity and communication skills emerge. The findings confirm that innovation needs collective learning from different parties (Boni et al., 2009, CCI, 2007, Thursby et al., 2009). In particular, communication skill enables inventions that can be commercial

⁴⁵ Interviewed with the Deans of all faculties examined.

⁴⁶ Interviewed with the Dean of Fine & Applied Arts at Thammasat University.

⁴⁷ Interviewed with the Deans of Business Administration and Engineering at Bangkok University; the Dean of Engineering at RMUTR.

as inventors can communicate with users or customers (Johnson (2009)). The Faculty of Architecture (at Chulalongkorn University) and the Faculty of Communication Arts (at Bangkok University) train students to communicate with their peers through team assignments since creative thinking must be communicated to other people. The Faculty of Fine & Applied Arts (at Chulalongkorn University) and the Faculty of Painting, Sculpture & Graphic Arts (at Silpakorn University) also assign students to create their group projects since they believe that articulation and co-operation among students can lead to the art works that are massive. The Dean of Engineering at Rajamangala University of Technology Rattanakosin mentioned that the robot project involved 7-8 students, and each of them was responsible for each particular task such as controlling, programming or maintaining. In addition, according to a policy of the Engineering Faculty, Rajamangala University of Technology Phra Nakon, all subjects have to assign the team-working project to students.

At third, experience-based learning is a method that lecturers give flexibility and chances for students to learn by doing, from trial-and-error, and from real environment. The findings confirm that experiential learning enables students to experiment and discover new ways of thinking (Dewett and Gruys, 2007, NESTA, 2008). The evidence shows that lecturers drive students to think and create projects by themselves while the lecturers tend to listen and give comments for improvement. The projects or assignments are related to situations occurring in the real environments. For example, at Thammasat University, the Faculty of Fine & Applied Arts brings students to stay with people in local communities, and requires students to generate new outputs such as a play, a product design and a dance. Students go through a process of being trial-and-error until they find a suitable method to complete the outputs. Along the way, lecturers provide advices.

In addition, the Dean of Architecture at Chulalongkorn University said that the faculty brought students to stay in the Nan province for five days, and asked the students to produce new products for the local village from its local materials. One of the students could create a new design of packaging made from a glass bottle decorated with papers made from corn skins. Another one could create a decorated glass bottle of salt for face scrubbing. In addition, the Faculty of Fine & Applied Arts, Bangkok University, facilitates projects that students learn together with a local community. Students were asked to help improve packaging of local products, and could increase a method of carpet knitting from one way to 30-40 methods. Furthermore, the Faculty of Architecture & Design, Rajamangala University of Technology Rattanakosin, requires students to arrange and organise a

seminar by themselves. They have to find a topic and contact guest speakers to present that particular topic.

At fourth, an approach of problem-based learning focuses on problem-finding and problem-solving methods. The problem-finding method requires students to identify what problems are. The problem-solving method aims to urge students to find an appropriate answer for the particular problem⁴⁸. Students have to conduct research and search for information to indicate problems and later provide solutions. For example, the Fine & Applied Arts (at Chulalongkorn University) and Architecture (at Thammasat University) encourage students to conduct research and explore problems before framing new ideas. Also, the Faculty of Communication Arts, Chulalongkorn University, stimulates students to think, find problems and try several solutions for the problems. A new solution can be an innovation. In the Fine & Applied Arts Faculty, Bangkok University, students are taught to set up questions by using a technique of journaling. Students then can elaborate on information in the journal to create new works. The Dean of Engineering at Dhurakij Pundit University indicated that the faculty used a problem-based method to encourage students to seek for problems and offer solutions for the problems. Similarly, the Dean of Business Administration at the same university suggested that lecturers had to set up questions or problems for students to discuss in every class. The Dean of Science & Technology at Suan Dusit Rajabhat University said that the faculty tended to provide questions for student to find solutions. In addition, the Engineering Faculty, Rajamangala University of Technology Rattanakosin, has urged students to create projects or solutions according to topics given by lecturers since they were in the first year of study. The results support that problem-finding and problem-solving methods are important to stimulate innovation (Harkema and Schout, 2008).

At fifth, with a method of practical learning, students have to apply theories to their researches, projects or assignments⁴⁹. Because of practicing, students can learn what ideas and outputs can be invented and commercialised in the real world⁵⁰. Practicing has been embedded in the creative disciplines in a way that students are stimulated to think, experiment, increase skills and take risks by

⁴⁸ Interviewed with the Dean of Fine & Applied Arts at Chulalongkorn University.

⁴⁹ Interviewed with the Dean of Communication Arts at Bangkok University.

⁵⁰ Interviewed with the Dean of Science & Technology at Suan Sunandha Rajabhat University.

doing. For example, students in the faculties of science studies have to experiment in laboratories⁵¹. The engineering and architecture studies need students to create prototypes of their ideas. Students in the arts study cannot avoid practicing as they have to turn their abstract ideas into visible outputs.

At sixth, making a presentation helps students show and express their ideas into the representational outputs for other people. Students need to be able to describe their works otherwise they will get low marks of evaluation⁵². Lecturers can evaluate and understand the students' projects when students can present their art works appropriately. In the class, students are required to present their works to the class. By practicing presentation, students can develop confidence to think and show their ideas, thereby gradually creating their own identities. For example, the Faculty of Architecture, Silpakorn University, teaches students to present their works when students are in the first year of study. In addition, the Fine & Applied Arts Faculty, Bangkok University, demands students to be able to translate their ideas into visible symbols that can be communicated. Moreover, the Dean of Communication Arts at Dhurakij Pundit University indicated that the nature of communication arts discipline embraced presentation as seen in the Departments of Public Relations and Radio & Television. The Architecture & Design Faculty, Rajamangala University of Technology Rattanakosin, provides the Presentation Techniques subject for students because students have to communicate with customers and colleagues (from different professions such as engineering) in the future.

At last, an evaluation by lecturers can improve students' innovation skills: not block their creativities and innovations. A group of commentators provide scores and comments from variously different perspectives to improve students' projects. All faculties explicate that the evaluation system makes students think creatively and realistically because of a certain degree of freedom for initiatives and specific requirement. This method leads to improvement and a challenge for students' innovation skills. The Faculty of Fine & Applied Arts, Chulalongkorn University, mentioned that the proper criteria of evaluation actually increased creativity that is likely to be commercialised in the real world.

⁵¹ Interviewed with the Dean of Science & Technology at Suan Sunandha Rajabhat University.

⁵² Interviewed with the Dean of Architecture at Silpakorn University.

4.4.5 Fostering students' extra-curricular activities

At the fifth mechanism, fostering students' extra-curricular activities helps students to develop innovation skills, as mentioned by CCI (2007). Activities (such as joining the student unions or clubs and taking part in the competitions) can create environments for self-learning⁵³. The evidence shows that all faculties encourage students to join the activities to develop innovation skills. The Deputy Dean of Industrial Technology at Suan Sunandha Rajabhat University suggested more activities to foster unity and collaboration among students in the faculty. From the empirical evidence, extra-curricular activities leading to innovation skills include 1) an idea or innovation-related contest, 2) an exhibition of students' outputs, 3) an excursion, 4) a guest-speaking session, 5) a student club or camp, and 6) a meditation activity. Through extra-curricular activities, students learn to search for information and sources of information, to cooperate with colleagues, to find solutions for particular problems, to think creatively, to communicate with other people, to take risk and to have responsibility for completing their tasks⁵⁴. In particular for the Engineering, Computer science and Fine Arts disciplines, students need to develop more communication skills to be able to explain their ideas to group members so that the others can help turn the idea into innovation, which extra-curricular activities can assist with such skill improvement⁵⁵.

To commence with the first extra-curricular activity, taking part in a contest of new ideas or innovations pushes students to think creatively, apply knowledge to new problems, work in teams, connect with team members, make their own decisions and encounter uncertainty⁵⁶. More contests and stages are required for students since the students will gain experiences and build-up their portfolios, thereby increasing opportunities of employment in the future⁵⁷. Also, the universities can earn reputations when their students win the contests⁵⁸. Table 4.2 presents examples of contests.

⁵³ Interviewed with the Dean of Architecture & Planning at Thammasat University.

⁵⁴ Interviewed with the Deans of all faculties examined.

⁵⁵ Interviewed with the Deans of Engineering and Fine & Applied Arts at Chulalongkorn University; the Dean of Decorative Arts at Silpakorn University; the Dean of Fine & Applied Arts at Thammasat University; the Dean of Science & Technology at Suan Dusit Rajabhat University; the Dean of Engineering at RMUTR.

⁵⁶ Interviewed with the Dean of Commerce & Accountancy at Chulalongkorn University; the Dean of Architecture at Silpakorn University; the Dean of Architecture & Design at RMUTR.

⁵⁷ Interviewed with the Dean of Engineering at Thammasat University.

⁵⁸ Interviewed with the Dean of Communication Arts at Chulalongkorn University; the Dean of Industrial Technology at Suan Sunandha Rajabhat University.

Table 4.2 Examples of student contests

University	Faculty (Example)	Contests (Example)
Chulalongkorn University	Engineering	Students joined the contests of, for examples: -Designing a software programme to identify a song title from a tune. -Joining the RoboCup contest. -Creating the robotic arm for disabled people for the Brands Gen contest.
	Commerce & Accountancy	Students from several faculties created a community project to improve communities for the SIFE (Students in Free Enterprise) contest.
	Fine & Applied Arts	Students from the Creative Arts joined contests.
Thammasat University	Architecture & Planning	Students submitted their theses to the contests.
Silpakorn University	Architecture	Outputs of students were sent to compete in the national and international contests (e.g. New York, USA).
Dhurakij Pundit University	Engineering	Students created robots to compete in the contests such as the TPA Robot Contest, the World Alternative Energy Sciences Expo and Toyota Smart Robot Contest.
	Communication Arts	Students joined the contests such as the Contest of Thai Journalist Association and the Short Film Competition of Thai Health Promotion Foundation.
	Information Technology	Students joined the SIPA Game Contest and the Animation Contest.
Bangkok University	Engineering	Students joined the SIPA Competition.
	Fine & Applied Arts	Students joined the Bangkok Design Festival.
Suan Sunandha Rajabhat University	Management Science	Students from the Information Technology Department joined the e-commerce contest. Students from the Communication Arts Department joined the Short Film competition.
Suan Dusit Rajabhat University	Science & Technology	Students competed in the Information Technology contest.
Rajamangala University of Technology Rattanakosin	Architecture & Design	Students took part in the contest of, for examples: -Designing furniture to compete in the contest held by the Department of Intellectual Property. -Designing a website against AIDS.
	Engineering	Students joined the robot contests such as winning the 4 th place of the World Robocup 2011.
Rajamangala University of Technology Phra Nakon	Industrial Textiles & Fashion Design	Students created pillowcase made from woven fabric for the Doitung for COITTO Collection Competition.
Rajamangala University of Technology Krungthep	Engineering	Students joined the robot contests.

Source: Author, empirical investigations

Secondly, an exhibition provides opportunities for students to demonstrate their new ideas or outputs. Through the exhibition, students' outputs are presented to a public, and there are some possibilities to commercialise students' outputs. The final-year students are required to present their final theses to publics and companies by organising exhibitions at a faculty, a gallery, a museum or a department store, as examples⁵⁹. Moreover, the Dean of Fine & Applied Arts at Bangkok University explained that students got together to renovate an old building to be a gallery for their art demonstration. In addition, the Faculty of Information Technology, Dhurakij Pundit University, organises an event called 'IT Pow' to show students' outputs and challenge their new ideas. A reward of 3,000 baht is provided for the winner of the challenge. The Faculty of Science & Technology, Suan Dusit Rajabhat University, holds an annual exhibition called 'Science Festival' for students to present their works or projects. A theme of the exhibition is set up as a scope for the students' outputs. In the Faculty of Industrial Textiles & Fashion Design, Rajamangala University of Technology Phra Nakhon, students themselves organise an exhibition to show their fashionable products and new designs to publics and companies.

Thirdly, an excursion to factories, companies, communities or other countries can broaden students' views and provide external experiences from outside environments⁶⁰. For example, during summer, students at the Departments of Creative Arts and of Visual Arts in the Faculty of Fine & Applied Arts, Chulalongkorn University, can visit the University of Birmingham in England to gain experiences and perspectives from abroad. These activities build abilities to come up with creativity, work in a team, address problems, solve problems, take risk, and foresee opportunities for business in the future. Moreover, students in the Faculty of Fine & Applied Arts at Bangkok University visit nearby communities and use their knowledge to improve the particular areas through the CSR project. Similarly, the Faculty of Industrial Technology, Suan Sunandha Rajabhat University, took students to observe lifestyles of local communities and identified the particular problems in the communities so that the students could offer solutions, such as designing and adjusting food machines to speed up a food product process. The Faculty of Management Science, Suan Dusit Rajabhat University, takes students to observe working processes in companies. Similarly, the Industrial Textiles & Fashion Design Faculty, Rajamangala University of Technology Phra Nakhon,

⁵⁹ Interviewed with the Deans of Architecture and Fine & Applied Arts at Chulalongkorn University; the Dean of Decorative Arts at Silpakorn University; the Deans of Fine & Applied Arts and Architecture & Planning at Thammasat University; the Dean of Fine & Applied Arts at Bangkok University.

⁶⁰ Interviewed with the Dean of Industrial Technology at Suan Sunandha Rajabhat University.

brings students to visit companies and local communities to get inspirations and practice to solve real problems.

Fourthly, a guest-speaking session helps students to learn from experts' experiences. For example, the Faculty of Commerce & Accountancy, Chulalongkorn University, invites external experts or alumni members – e.g. the CEO of the Bathroom Design Company that successfully operates business based on innovation design, function and technology – to give inspirations and share experiences to students. So does the Faculty of Industrial Textiles & Fashion Design, Rajamangala University of Technology Phra Nakon.

Fifthly, for a student club or a camp, students have chances to initiate activities or plans, to cooperate with other students and to lead other club members. The findings confirm that students need opportunities to learn, experiment and practice skills through activities in clubs, students' union and societies (NESTA, 2008). For example, an activity to welcome new students, known as 'a freshy day', allows students at the Faculty of Architecture, Chulalongkorn University, to set up a theme and design activities. Also, the students can exercise their innovation skills by holding the play, annually. In 2011, the play was titled as 'White & Black', which the students created the story and stage based on only two colours of white and black. The student union at the Faculty of Commerce & Accountancy, Chulalongkorn University, has to plan for new activities in each year. Also, the Student Relations has to categorise the first-year students into twelve groups where each group has to arrange their own activities such as a farewell party for senior students. The Faculty of Communication Arts, Bangkok University, encourages students to join activities such as a sport game, a freshy day and a speech club. In addition, Dhurakij Pundit University arranges DPU Game for students from all faculties to play sports. Moreover, students from the Communication Arts Programme, the Faculty of Management Science, Suan Sunandha Rajabhat University, have cooperated to establish a creative media club. The club members help each other to hold events for customers. Also, the faculty provides a creative-media camp that students are trained to improve leadership skill and creativity at the soldier camp.

Finally and interestingly, a meditation activity is brought into the Faculty of Engineering, Chulalongkorn University, to train students to be conscious. The Meditation Room was established for students to practice mediation. The Deputy Dean of the faculty said that consciousness enabled intelligence, resulting in innovation to a certain degree.

4.4.6 Providing appropriate resources

Providing appropriate resources, as the last mechanism, can nurture innovation skills to students. From the empirical evidence, the appropriate resources include financial supports and time, spaces for innovations, and opportunities for networking. The findings are consonant with the notion that students can develop innovative behaviours when they experience pedagogies and environments that facilitate innovation (Hargadon and Sutton, 2000, Harkema and Schout, 2008). Financial support can motivate and support students to build innovation skills. Through rewards for outstanding students and funding for generating innovations, students will compete to induce innovations. For example, the Faculty of Commerce & Accountancy, Chulalongkorn University, provides sufficient budgets to support students' extra-curricular activities. Apart from financial support for students, all faculties provide grants for lecturers to develop their competencies (e.g. further educations, training and exhibitions). Bangkok University launches a campaign called "Idea Exchange Million" that students with a good idea can ask for funding from the university for the idea implementation⁶¹. Similarly, Suan Sunandha Rajabhat University provides funding, called "The Best", to support the outstanding students in all faculties to take part in competitions. Furthermore, students and lecturers who intend to induce innovations require sufficient time to initiate and implement their projects⁶².

Secondly, students and lecturers require environments and spaces for learning, exploring, practicing, announcing and commercialising their innovations. The Faculty of Engineering at Chulalongkorn University and the President of Bangkok University emphasise that the appropriate environment engenders innovations. For example, at the Faculty of Engineering, Chulalongkorn University, students can use an activity room to practice and build robots for the robot contests. Spaces for self-learning, workshop, laboratories and a mediation room are available. Similarly, the Faculty of Communication Arts (at Chulalongkorn University), the Faculty of Architecture (at Silpakorn University) and the Faculty of Fine Arts (at Suan Sunandha Rajabhat University) provide spaces (e.g. activity rooms, studios, museums, galleries and theatres) for students to practice their specific skills and demonstrating their works (e.g. drawing, painting, Thai dancing and playing music). At the Faculty of Commerce & Accountancy, Chulalongkorn University, the management theatre has been

⁶¹ Interviewed with the Deans of Engineering, Fine & Applied Art and Business Administration at Bangkok University.

⁶² Interviewed with the Deans of Engineering at Bangkok University.

built⁶³. The room layout is similar to the theatre that has a stage and spotlight. Chairs can pull out from four directions around the room. Therefore, each class can design the layout of the room for the particular activity or purpose.

Furthermore, the universities encourage students to induce innovations by providing stages to demonstrate their outcomes. In particular, Bangkok University has established the Bangkok University Creative Centre (BUCC) to generate students' creative thinking and demonstrate their innovative outcomes. Moreover, events and fairs are held by the faculties with an aim to boost students' ideas and show their innovations. For example, the Faculty of Business Administration, Dhurakij Pundit University, arranges the Business Day and the Business Fair called 'Tao-Kae-Noi' to present students' business plans and commercialise their products. As mentioned, all faculties of Fine & Applied Arts examined organise exhibitions annually to show students' outputs.

Finally, an opportunity to network with other universities and companies can support students to create and commercialise their outputs to a certain degree. The evidence shows that some faculties, through lecturers and students, collaborate with external firms to innovate projects and researches. As mentioned previously, the lecturers and students at the Faculty of Engineering, Bangkok University, collaborate with MK Restaurants to produce the robots. The students at the Faculty of Engineering, Chulalongkorn University, induce a shopping cart that can automatically follow the particular customers for a supermarket. The Faculty of Engineering at Rajamangala University of Technology Phra Nakhon exchanges students with other universities in Germany and Canada, as examples, to broaden students' views on creating and producing robots⁶⁴. The results confirm that a strong link between education and firm engenders open-up education system to distributed learning in the society (Chell and Athayde, 2009).

4.5 Difficulties in nurturing innovation skills

In spite of six mechanisms that nurture innovation skills, the faculties have encountered some difficulties that limit the growth of innovative graduates. Such difficulties include incompetent

⁶³ Interviewed with the Deputy Dean of Commerce & Accountancy at Chulalongkorn University.

⁶⁴ Interviewed with the Dean of Engineering at RMUTP.

students, too big class size, insufficient budgets, insufficiently appropriate spaces, equipments and lecturers, and a limitation from implementing TQF.

4.5.1 Incompetent students

The empirical evidence reveals that a quality of students can influence the development of students' innovation skills. In the faculties that are able to choose the qualified students to study their courses, a majority of students are competent to generate ideas and induce innovations, only with a small advice from lecturers⁶⁵. On the other hand, in the faculties having students with limited qualities, only a small amount of students can develop their skills toward innovations⁶⁶.

4.5.2 Too big class size

Students have limited opportunities to practice, discuss and articulate – which are important to push up their innovation skills to a higher level of their competencies – when there are too many students in a classroom⁶⁷. Especially for a professional education such as Scriptwriting, an amount of students in a class should not be over 50 students⁶⁸.

4.5.3 Insufficient budgets

Limited financial supports can obstruct the development of innovation skills⁶⁹. Additional budgets will reduce frustration and stress of lecturers and students to induce innovations⁷⁰. For example,

⁶⁵ Interviewed with the Dean of Engineering at Chulalongkorn University; the Deans of Architecture & Planning and Fine & Applied Arts at Thammasat University; the Deans of Decorative Arts and Architecture at Silpakorn University; the Dean of Fine Arts at Suan Sunandha Rajabhat University.

⁶⁶ Interviewed with the Deans of Engineering, IT, Communication Arts at Dhurakij Pundit University; the Deans of Management Science and Science & Technology at Suan Dusit Rajabhat University; the Dean of Industrial Technology at Suan Sunandha Rajabhat University; the Dean of Industrial Textiles & Fashion Design at RMUTP; the Dean of Engineering at RMUTR.

⁶⁷ Interviewed with the Deans of Fine & Applied Arts at Chulalongkorn University and Thammasat University; the Dean of Architecture at Silpakorn University; the Dean of Communication Arts at Dhurakij Pundit University; the Dean of Science & Technology at Suan Dusit Rajabhat University; the Dean of Fine Arts at Suan Sunandha Rajabhat University; the Deans of Engineering and Industrial Textiles & Fashion Design at RMUTP; the Dean of Architecture & Design at RMUTR; the Dean of Engineering at RMUTK.

⁶⁸ Interviewed with the Dean of Communication Arts at Dhurakij Pundit University.

⁶⁹ Interviewed with the Dean of Decorative Arts at Silpakorn University; the Dean of Communication Arts at Dhurakij Pundit University; the Dean of Engineering at RMUTR.

⁷⁰ Interviewed with the Deans of Fine & Applied Arts at Chulalongkorn University and Thammasat University; the Dean of Architecture at Silpakorn University; the Dean of Communication Arts at Dhurakij Pundit University; the Dean of Science & Technology at Suan Dusit Rajabhat University; the Dean of Fine Arts at Suan Sunandha Rajabhat

students in the Faculty of Engineering, Rajamangala University of Technology Rattanakosin, encountered a problem that they could not buy all the materials needed to produce the robot for the World RoboCup contest because of limited financial budget from the universities and faculties.

4.5.4 Insufficiently appropriate spaces, equipments and lecturers

Although spaces and equipments are provided, an insufficiency of those resources can slow down the development of innovation skills. Facilities such as computer labs, activity rooms and an internet landline should be provided 24 hours⁷¹. The Dean of Architecture & Planning at Thammasat University mentioned that students were not likely to design extremely out-of-the-box projects unless technologies or machines capable of producing the prototypes of the projects were available. Also, the Faculty of Decorative Arts at Silpakorn University needs the university to help with finding more spaces for holding art exhibitions⁷². The Faculty of Fine & Applied Arts, Chulalongkorn University, needs to improve a library and Wi-Fi as a channel to broaden students' views and knowledge⁷³. In addition, sometime, students have limited opportunities and time to practice and induce their works as activity rooms are not enough for students⁷⁴.

Importantly, there are not enough competent lecturers, in proportion to an amount of students, to teach and give advice to students' projects⁷⁵. Furthermore, lecturers sometime cannot improve their researching competencies as they have to deal with many loads of teaching, thereby reducing time for conducting research. Moreover, it is not easy to change lecturers' attitudes as they tend to have a high level of self-confidence in their beliefs and expertise. For example, lecturers in the scientific fields tend to be less interested in business and commercialisation, thereby generating more inventions than innovations⁷⁶. However, in some cases, it is difficult for the faculty to drive

University; the Deans of Engineering and Industrial Textiles & Fashion Design at RMUTP; the Dean of Architecture & Design at RMUTR; the Dean of Engineering at RMUTK.

⁷¹ Interviewed with the Deans of IT and Communication Arts at Dhurakij Pundit University.

⁷² Interviewed with the Dean of Decorative Arts at Silpakorn University.

⁷³ Interviewed with the Dean of Fine & Applied Arts at Chulalongkorn University.

⁷⁴ Interviewed with the Dean of Architecture at Silpakorn University; the Dean of Fine & Applied Arts at Thammasat University; Dean of Industrial Textiles & Fashion Design at RMUTP.

⁷⁵ Interviewed with the Dean of Decorative Arts at Silpakorn University.

⁷⁶ Interviewed with the Dean of Science & Technology at Suan Dusit Rajabhat University.

lecturers' research and pursue further education because some lecturers may have low self-motivation to explore new knowledge⁷⁷.

4.5.5 A limitation from implementing TQF

Following Thai Qualification Framework (TQF) established by the Office of the Higher Education Commission that requires an increase of fundamental subjects, some faculties cannot develop the integrated curriculum within limited years of study. Especially, in the discipline of Fine & Applied Arts, some faculties are unable to put various subjects related to their professional education into the course as they have to provide several fundamental subjects⁷⁸. Similarly, some faculties cannot offer business subjects to students because of a tight schedule of the course⁷⁹.

4.6 Lessons learned

The universities and faculties play an important role to nurture innovation skills of their students in the creative faculties. To be innovative, students have to develop seven skills, encompassing creativity, self-efficacy, energy, risk-propensity, leadership, entrepreneurship and socialisation. The key issues learned from the study are highlighted:

4.6.1 Innovation skills: Learning through the formal education system

Innovation skills can be developed throughout a process of learning in the formal education system. This argument has to be recognised by the management and lecturers if the faculties and universities want to nurture innovative graduates for the future. To build up skills needed for innovation, the faculties have to employ six mechanisms – including fine-tuning lecturers' attitudes on innovation, building lecturers' capabilities for innovation, developing integrated curriculum, designing pedagogies, fostering students' extra-curricular activities, and providing appropriate resources – in their courses.

⁷⁷ Interviewed with the Dean of Fine & Applied Arts at Thammasat University.

⁷⁸ Interviewed with the Dean of Painting, Sculpture & Graphic Arts at Silpakorn University.

⁷⁹ Interviewed with the Dean of Architecture at Silpakorn University; the Dean of Engineering at RMUTP.

4.6.2 Experiential learning as a core for nurturing innovation skills

Experiential learning gives opportunities for students to create their own educational experiences by integrating academic knowledge, practical implication and activities. Students can learn to apply theories to generate new solutions and innovations to the real problems. They learn by doing and can tolerate mistakes and failures since they have experienced the long process of generating innovations. Balancing learning in classrooms and from activities equips students with abilities to engender ideas that can be sold.

4.6.3 An integrated curriculum: Co-operating between disciplines

Innovation tends to come from articulation of different knowledge. Because of an integrated curriculum, students have opportunities to learn across disciplines, thereby increasing a possibility of mixing different knowledge. Beyond the wide variety of knowledge, students can make friends from different departments or faculties when they attend subjects in other departments or faculties. This leads to opportunities for collaboration of students who expert in different areas of study.

4.6.4 Business study: A tool for idea commercialisation

Students should learn about business and develop a sense of business if they want their creative outputs to be commercialised successfully. Students in the creative faculties tend to be able to create their specific outputs (e.g. scientific experiments, robotic products or art works), according to the specific requirements of the disciplines. However, innovation occurs when the students can commercialise their creative products or distribute the products to users. This brings about advantages and benefits to the innovators and customers. As a consequence, students can bring this ability to their future career.

4.6.5 Put the innovative students to the right environments

Innovation skills can be grown by providing appropriate environments surrounded. Innovation does not happen by chance. While six mechanisms mentioned earlier can enhance innovation skills, infrastructure can accommodate students' learning. Spaces, facilities, equipments and environments in the faculties and universities have impacts on students' motivations and attempts to induce innovations and develop their innovation skills.

4.6.6 Suggestions from the management

At the first place, management of the faculties and university should conduct research on market demand and trends in order to improve curricular and develop lecturers' competencies that are needed in the economy⁸⁰. The faculties and universities have to simultaneously create and improve all factors influencing curricular, pedagogies and lecturers' capabilities toward innovations⁸¹. Importantly, providing seminar for lecturers, policies and evaluations will assist with lecturers' attitudes adjustment⁸².

4.7 Conclusion

With an attempt to explore how universities produce innovative graduates, this study examined twenty-five creative and five business faculties in ten universities in Bangkok. The study found that the faculties, sometimes together with hands from universities, play an important role to nurture students' skills needed for innovation. It is widely known that creativity is a compulsory to the creative disciplines. However, commercialisation and/or wide utilisation of the creative outputs can yield utmost advantages and benefits. Therefore, innovation skills encompass not only creativity, but also self-efficacy, energy, risk-propensity, leadership, entrepreneurship and socialisation. Interestingly, innovation skills can be learned through a formal education system. Six mechanisms, that can develop innovation skills, include fine-tuning lecturers' attitudes on innovation, building lecturers' capabilities for innovation, developing integrated curriculum, designing pedagogies, fostering students' extra-curricular activities, and providing appropriate resources. However, it is not easy to nurture innovation skills because of some limitations. In some cases, the management and lecturers may not have the right understanding on and attitudes toward innovations so that they may not put sufficient effort to develop innovation skills of students. In particular, lecturers with limited capabilities toward innovation may not be able to give advice that related to innovation to students. The TQF, in some cases, inhibits flexibility to design an inter-discipline course. Insufficient budgets may obstruct activities related to innovation skills. Environments for innovation should be

⁸⁰ Interviewed with the Dean of Fine & Applied Arts at Thammasat University.

⁸¹ Interviewed with the Dean of Engineering at Chulalongkorn University.

⁸² Interviewed with the Dean of Science & Technology at Suan Dusit Rajabhat University.

increased. Beyond the previous limitations, some students that have low motivations tend not to improve their competencies to induce innovations.



5.1 Revisiting the research process

5.1.1 An emerging gap and research questions

Due to limitations of the literature on the role of universities in producing innovative graduates, a gap was identified in *Chapter Two*. Briefly, there has been an increase in literature on universities as an R&D activity and an incubation activity to induce innovation in the National Innovation System (NIS). In fact, one of the main functions of universities in the NIS is producing graduates who possess skills needed for innovation because the graduates will be an innovative workforce in the economy. Therefore, the issue worth investigation is a way that universities produce innovative graduates. Particularly, the gap cannot be explained by the literature. This research investigates this phenomenon based on two research questions (in *Chapter Three*):

1. What are skills that students need to develop to be able to induce innovations?
2. How do universities nurture students' innovation skills?

5.1.2 Methodology

Chapter Three explained how a multiple-case study was applied. Ten universities, classified into public universities, private universities, Rajabhat universities and Rajamangala universities of technology, were examined. Embedded in the chosen universities, thirty faculties offering knowledge related to the creative and business disciplines were investigated. The fieldwork was conducted in Bangkok. The data was collected through in-depth and semi-structured interviews with the Deans and Deputy Deans of the faculties between May and August 2011. Secondary data were gathered from the annual reports and websites of the faculties.

5.2 Recalling findings and discussions

In *Chapter Four*, the study showed that the education agencies can help developing students' innovation skills. While the universities play a supportive role, the faculties are key actors to nurture innovation skills of students. Innovation skills encompass creativity, self-efficacy, energy, risk-propensity, leadership, entrepreneurship and socialisation. Six mechanisms, that can develop innovation skills, include fine-tuning lecturers' attitudes on innovation, building lecturers' capabilities for innovation, developing integrated curriculum, designing pedagogies, fostering students' extra-curricular activities, and providing appropriate resources. However, some limitations on fostering such skills of students can occur. There are five main arguments reflected from this study.

Firstly, innovation skills can be nurtured through the learning process in the formal education system. The concept of student-centred learning facilitates students to learn by doing and by trials-and-errors, thereby offering students to create their own experiences and develop skills needed for innovation. Together with academic knowledge, extra-curricular activities enable students to develop innovation skills through problem-based, creative and team-working activities.

Secondly, through student-centred learning for innovation, the role of lecturers has to be transformed. Lecturers have to act as a coach who provides guidance and questions (not answers) for students; as well as, a commentator who criticise students' projects and performances with the aim at improving students' potentials. Importantly, lecturers, as the role model for students, have to pass the positive attitudes toward innovation and its importance to their students.

Thirdly, as innovation often occurs from integration of diverse knowledge, an integrated curriculum equips students with an ability to elaborate on diverse knowledge to induce term projects or projects for the contest. Moreover, students can learn to work with and learn from other students who have different backgrounds of knowledge.

Fourthly, as mentioned earlier, innovation does not happen by chance. The proper environment surrounding lecturers and students can enable the development of students' innovation skills. The physical environment (i.e. infrastructure, spaces, facilities and technical equipments) and financial support provided by the faculties and universities can stimulate students' learning toward innovation skills. The reward system (i.e. financial reward, recognition and flexibility of working time) is an

important factor to motivate both lecturers and students to put efforts in developing students' innovation skills.

Finally, nurturing innovation skills requires the management and lecturers to perceive that innovation brings about the growth of economy, and innovative graduates are increasingly recruited by companies. This attitude toward innovation will enable the management and lecturers to put sufficient effort to develop innovation skills of students. Furthermore, some lecturers have to develop capabilities toward innovation so as to give the right suggestions related to innovation to students. Building innovative graduates demands sufficient investment in human resources, infrastructures and activities.

5.3 Contribution to educational practices and policy makers

To capitalise the findings, some implications are highlighted here for educational practices and policy makers.

For educational practices, top management of universities whose possess visions on producing an innovative workforce for the future have to commit to and understand the nature of innovation and put fully efforts to communicate an importance of innovation across the organisations. The universities and faculties should realise that cost-cutting may not yield the innovative graduates. Instead, building innovative graduates requires investment that will bring back returns for the long run. Networking across departments, faculties, universities and sectors will enable innovation and development of an innovative workforce, with appropriate investment and risk. The interdisciplinary curriculum should encompass both creativity and its commercialisation. It is not necessary to establish a standalone innovation course or subject. Innovation skills can be nurtured through a combination of mechanisms throughout the regular courses.

For policy makers, the government should draw policies to encourage and support universities to nurture students' skills needed for innovation while driving the creative economy. The human resources policy of the nation should focus on building and increasing an innovative workforce, which is beyond the creative workforce. An issue of intellectual property right for innovations

induced by students and faculties must be studied. The process of applying the intellectual property right should be adjusted for academia.

5.4 Applicability of the research and agenda for further research

5.4.1 Applicability of the research

While this research provides insights into the particular issues on producing innovative graduates, it still contains some limitations.

1. The findings of this empirical study are enriched with evidence from thirty interviews of management in twenty-five creative and five business faculties in ten universities in Bangkok. The purpose of this research is not intended to offer general explanations in other settings. Instead, it provides an in-depth analysis of mechanisms used by the selected faculties and universities to nurture students' innovation skills. The conclusion of this research has limited applicability in other settings or cases. However, applicability of the findings into other settings may yield the theoretical generalisation.
2. Given limitations of time and resources, this research concentrated on six creative disciplines provided by thirty faculties of ten universities in Bangkok. Other disciplines may utilise the particular mechanisms to develop students' innovation skills. Moreover, universities outside Bangkok may have particularly local experiences in producing innovative behaviours of their students. The assumption of creative industries used as a guide in selecting faculties in this research may need to expand in order to suit the specificities of Thailand.
3. During the fieldwork, there were constraints due to time and financial resources in collecting data. During the fieldwork, as this research was conducted by using elite interviews, it was difficult to gather data from the management of thirty faculties within the scheduled timeframe. Some interviews were arranged with the representatives of the management of the faculties. However, the management of the universities did not respond to interview requests.

5.4.2 Agenda for further research

Potential further research should explore demands for an innovative workforce from a perspective of employers and markets in Thailand. In particular, further research should investigate ways that universities, faculties and external organisations from different disciplines or practices collaborate to produce innovative graduates. Moreover, an impact of social networking, as virtual extra-curricular activities, on producing innovative graduates should be studied.

5.5 Concluding remarks

The mechanisms, used by the faculties in the universities examined, to foster students' skills needed for innovation are studied throughout this research. Students' innovation skills can be nurtured by the formal education system. The faculties can employ six mechanisms – including fine-tuning lecturers' attitudes on innovation, building lecturers' capabilities for innovation, developing integrated curriculum, designing pedagogies, fostering students' extra-curricular activities, and providing appropriate resources – in their courses to build up such skills.

Through experiential learning and integrated curricular, students have opportunities to learn to apply theories to generate new solutions or innovations to the real problems. Lecturers play a role as a coach, a guide and a commentator. Particularly, students should be able to combine knowledge of business and design (or arts) in order to innovate. Innovation is not serendipity. Students having innovation skills should be an intention of education agencies. Skills needed for innovation can be produced by providing appropriate environments surrounded. However, the education agencies should be aware of that building up innovation skills requires full effort and resources to overcome the limitations that may occur. This research particularly examined the selected faculties and universities. However, it might be an inspiration for other education agencies to capitalise on mechanisms used to nurture skills needed for innovation.

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Appendix 1: An interview guide

Interview questions for the Management of the faculties:

1. How important is innovation to the nation, society and your faculty?
2. How does your faculty help enabling innovation, in terms of educating, researching and intermediating? Which role acquires the most contribution from your faculty?
3. How important is your role in nurturing innovation skills of students?
4. Is your role in nurturing students' innovation skills important to your positioning? Why?
5. How does your faculty build up innovation skills of students?
6. How does your faculty support to increase lecturers' knowledge, capabilities and skills to nurture students' innovation skills?
7. How does your faculty manage to nurture students' innovation skills, in terms of organisational management?
8. Would you please suggest your faculty to nurture innovation skills of students?

Appendix 2: A list of interviewees

University classification	University	Position of interviewee	Faculty	Interviewing date
1. Public university	1. Chulalongkorn University	1. Deputy Dean	Engineering	01 June 2011
		2. Dean	Communication Arts	12 August 2011
		3. Dean	Architecture	03 June 2011
		4. Dean	Fine & Applied Arts	03 June 2011
		5. Deputy Dean	Commerce & Accountancy	21 July 2011
	2. Silpakorn University	6. Dean	Decorative Arts	25 July 2011
		7. Dean	Architecture	27 July 2011
		8. Dean	Painting, Sculpture & Graphic Arts	27 July 2011
	3. Thammasat University	9. Dean	Fine & Applied Arts	21 July 2011
		10. Dean	Architecture & Planning	08 June 2011
2. Private university	4. Bangkok University	11. Dean	Engineering	08 June 2011
		12. Dean	Communication Arts	07 June 2011
		13. Dean	Fine & Applied Arts	08 June 2011
		14. Dean	Business Administration	15 June 2011
	5. Dhurakij Pundit University	15. Dean	Information Technology	10 May 2011
		16. Dean	Engineering	10 May 2011
		17. Dean	Communication Arts	13 May 2011
		18. Dean	Fine & Applied Arts	01 August 2011
		19. Dean	Business Administration	12 May 2011
3. Rajabhat University	6. Suan Dusit Rajabhat University	20. Dean	Management Science (Communication Arts Programme & Business Administration Programme)	09 June 2011
		21. Dean	Science & Technology	05 August 2011
	7. Suan Sunandha Rajabhat University	22. Dean	Management Science (Communication Arts Programme & Business Administration Programme)	21 June 2011
		23. Dean	Fine Arts	15 June 2011
		24. Deputy Dean	Industrial Technology	03 August 2011
		25. Dean	Science & Technology	21 June 2011
4. Rajamangala University of Technology	8. Rajamangala University of Technology Phra Nakhon (RMUTP)	26. Dean	Engineering	22 June 2011
		27. Dean	Industrial Textiles & Fashion Design	26 June 2011
	9. Rajamangala University of Technology Rattanakosin (RMUTR)	28. Dean	Engineering	19 July 2011
		29. Dean	Architecture & Design	19 July 2011
	10. Rajamangala University of Technology Krungthep (RMUTK)	30. Dean	Engineering	26 July 2011

Appendix 3: Templates analysis

3.1 The first template

Categories are developed based on research questions, research framework, literatures and first two interviews with the management of the faculties.

1. Skills needed for innovation
 - 1.1 Creativity
 - 1.2 Self-efficacy
 - 1.3 Energy
 - 1.4 Risk-propensity
 - 1.5 Leadership
 - 1.6 Entrepreneurship
2. An importance of innovation to the nation, society and university itself
3. The role of the faculties in building innovation skills
4. An importance of nurturing students' innovation skills
5. An importance of nurturing students' innovation skills toward university's positioning
6. Mechanisms to nurture students' innovation skills
 - 6.1 A curriculum
 - 6.2 Extra-curricular activities (e.g. Sport events, idea contests etc.)
 - 6.3 Pedagogies
 - 6.4 Class room environment
 - 6.5 Collaboration with business sectors and other units in university
7. Activities to increase lecturers' capabilities and developments to build up students' innovation skills
 - 7.1 Lecturers' knowledge and capability
 - 7.2 Lecturers' development
8. Organisational structure
9. Leaders' visions and commitments
10. Resources that university and faculty provide to facilitate both activities
11. Suggestions to improve ways to nurture innovativeness in students

3.2 The second template

Emerging issues modify the first template to the second template.

1. Skills needed for innovation
 - 1.1 Creativity
 - 1.2 Self-efficacy
 - 1.3 Energy
 - 1.4 Risk-propensity
 - 1.5 Leadership
 - 1.6 Entrepreneurship
 - 1.7 Socialisation
2. An importance of innovation skills to students' career path
3. An importance of nurturing students' innovation skills (to universities and faculties)
4. An importance of nurturing students' innovation skills toward the organisation's positioning
5. Mechanisms to nurture students' innovation skills
 - 5.1 The attitudes of the management and lecturers toward innovation and students' innovation skills
 - 5.2 The abilities of lecturers to produce innovation skills of students
 - 5.3 The particular type of curriculum
 - 5.4 The concept of student centre and pedagogies
 - 5.5 Extra-curricular activities
 - 5.6 Collaboration with business sectors and other units in university
 - 5.7 Resources that universities and faculties provide to facilitate activities driving innovation skills
6. Organisational structure
7. Difficulties in producing innovation skills of students
8. Suggestions to improve ways to nurture innovation skills of students